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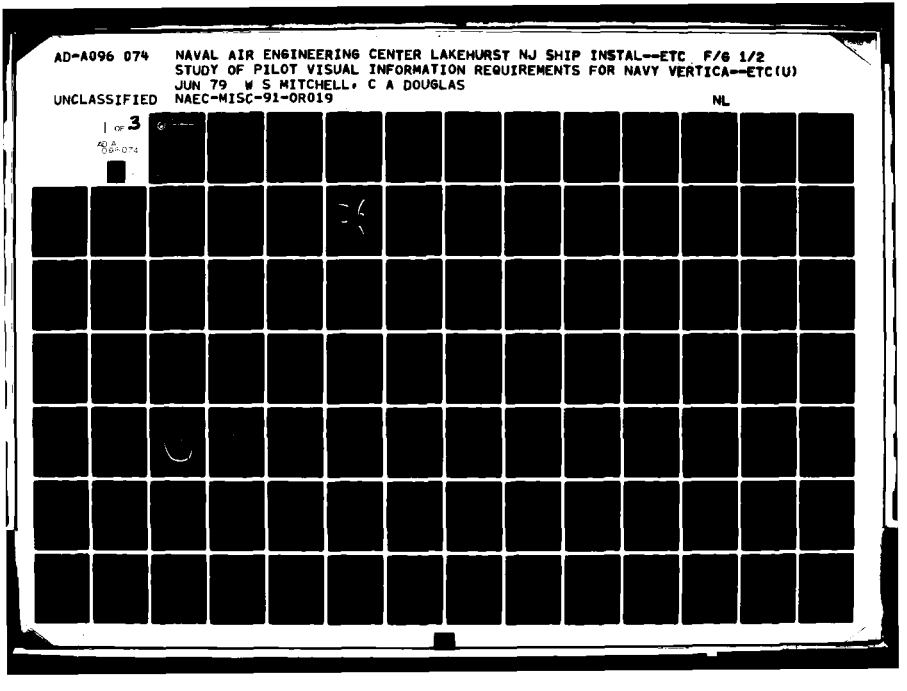

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STUDY OF PILOT VISUAL INFORMATION REQUIREMENTS FOR NAVY VERTICAL TAKE-OFF AND LANDING CAPABILITY DEVELOPMENT

QUANTA SYSTEMS CORPORATION

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STUDY OF PILOT VISUAL INFORMATION REQUIREMENTS FOR NAVY VERTICAL TAKE-OFF AND LANDING CAPABILITY DEVELOPMENT

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NOTICE

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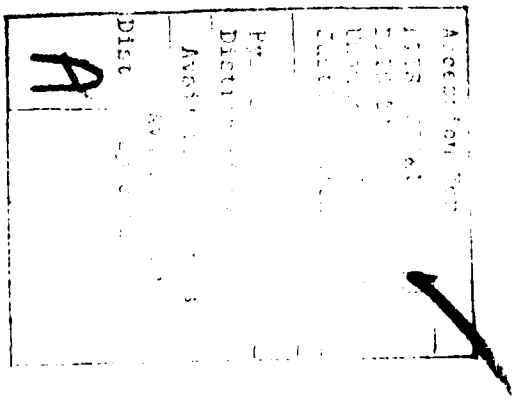

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ABBREVIATIONS

ADF	- Automatic Direction Finder
ASR	- Air Surveillance Radar
BRC	- Base Recovery Course
CTOL	- Carrier Take-Off and Landing
EMCON	- Emission Control
FLOLS	- Fresnel Lens Optical Landing System
FOD	- Foreign Object Damage
HIFR	- Helicopter In-Flight Refueling
HOBR	- Helicopter Onboard Radar
IFR	- Instrument Flight Rules
ILS	- Integrated Logistic Support
IMC	- Instrument Meteorological Conditions
LAMPS	- Light Airborne Multi-Purpose System
LSE	- Landing Signalman Enlisted
LSO	- Landing Signalling Officer
NAEC	- Naval Air Engineering Center
NATOPS	- Naval Air Training and Operating Procedures Standardization
NAVAIRSYSCOM	- Naval Air Systems Command
NAVTOLAND	- Navy Vertical Take-Off and Landing Capability Development
PAR	- Precision Approach Radar
PIL	- Point of Intended Landing
PIM	- Position and Intended Movement
RAST	- Rapid Assist Secure and Traverse
SATS	- Short Airfield for Tactical Support
SLED	- Helicopter Towed Mine Detection Equipment
TACAN	- Tactical Air Navigation
VERTREP	- Vertical Replenishment
VFR	- Visual Flight Rules
VLA	- Visual Landing Aids
VMC	- Visual Meteorological Conditions
V/STOL	- Vertical/Short Take-Off and Landing

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Development of Visual Landing Aid Requirements (Task 2 - Initial Analysis of Display Requirements), Pacer Systems, Inc.; Technical Report No. PAR-176-76; May 1976.

Validation of Pilot Information Requirements Matrix; Pacer System, Inc.; Technical Report No. PAR-273-77; February 1977.

NAVTOLAND Pilot Information Requirement Workshop (Briefing Guide for Helicopters); Quanta Systems Corporation; 1977.

NAVTOLAND Pilot Information Requirements Workshop (Briefing Guide for AV-8); Quanta Systems Corporation; 1977.

NWP-42 (Rev. C) Shipboard Helicopter Operating Procedures; Department of the Navy, Office of the Chief of Naval Operations.

NWP-63-1, Shipboard V/STOL Aircraft Operating Procedures; Department of the Navy, Office of the Chief of Naval Operations.

SECTION I - INTRODUCTION

This report provides a comprehensive analysis of pilot visual landing aid requirements for operation of helicopters and V/STOL aircraft from ship and shorebased sites.

The analytical effort spans a 5 year period commencing in 1974 and reflects the contributions of analyst Mr. R. Richards and Mr. J. Gilstrap of Pacer Systems Corporation, and analyst Dr. C. Freer, Mr. B. Evans and Mr. J. McKinley of Quanta Systems Corporation.

This report and more specifically, the analysis, conclusions, performance requirements and recommendations sections, was prepared by Mr. W. Scott Mitchell and Mr. Charles A. Douglas of Quanta Systems Corporation. The effort was performed under the direction of Mr. T. Momiyama of the Naval Air Systems Command and Dr. R. Shumaker, Mr. M. Kolodner, and Mr. S. Shay of the Naval Air Engineering Center.

The report is organized into eight sections starting with this introduction which further describes the requirement, background and approach to the study. The last four sections detail the terminology used to define pilot information, data tabulated as a result of pilot surveys, and typical existing VLA configurations. The analysis of the pilot data, evaluation of existing sources and identification of deficiencies are discussed in Section II for Helicopters and Section III for the AV-8A. The conclusions of the study, performance requirements and recommendations are described in Section IV.

A. NAVTOLAND PROJECT

The NAVTOLAND project was established to provide an integrated systems approach to improve operational capabilities of the helicopter and V/STOL aircraft employed to shipboard platforms and tactical shorebased sites. Currently, operations are restricted to a 200-foot ceiling, one-half nautical mile visibility, and sea state 3 ship motion limits. The goal of the project is to provide a capability to operate in zero ceiling, one-eighth nautical mile visibility and sea state 5. The project involves a coordinated development of the aircraft flight control and display systems to provide flying qualities with a satisfactory level of pilot workload; shipboard and tactical site installed approach and landing guidance systems; and visual aids to effect a precision touchdown. Further, the project emphasizes developments which can be applied toward improvement of the AV-8 HARRIER and result in a total all-weather and rough sea operation for all future Navy and Marine Corps V/STOL aircraft. The NAVTOLAND project considers a wide range of interacting elements:

- Flight controls/displays
- Guidance sensor system
- Visual Landing Aids
- Ship motion forecasting

- Aircraft hauldown/securing
- Pilot techniques
- Simulation
- Flight test

The development of these elements is directed toward providing the U.S. Navy 1980's and 1990's integrated V/STOL take-off and landing capability.

B. NAVTOLAND VLA ELEMENT

The development of the VLA element of the NAVTOLAND project involves organization of the following factors to guide the pilot:

- Dedicated displays or indicators for specific flight guidance parameters such as glide slope, line-up, attitude, etc. The well-known "meatball" aircraft carrier optical landing system is an example.

- Deck markings and lightings to enhance the pilot's perspective of the landing platform -- e.g., white floodlighting, deck edge and centerline markings and lights.

- Various natural cue elements which singularly or collectively give the pilot some secondary position, speed, attitude and other cues, such as grass on the runway, sea surface.

Within the context of the NAVTOLAND project, the VLA element concentrates on the definition of the necessary VLA package configurations which are:

- Integrated within the total visual scene of the pilot in all of the applicable segments in approach and landing.

- Usable for each class of ship and tactical site and respective V/STOL and/or helicopter operation.

- Standardized across aircraft types, ships and tactical sites as much as possible.

Such VLA packages will consist of:

- Existing lighting and optical systems validated as parts of the package (existing systems which are found to be inadequate, confusing or non-contributing would be eliminated).

- Additional lighting schemes and other visual cue enhancement devices.

- Other optical devices which may be coupled to non-VLA guidance and control sensors such as electronic guidance sensors, aircraft control systems or ship motion sensors.

In reviewing the general arrangement of the currently operational VLA assortment aboard a typical air capable ship, it becomes apparent that there is a substantial number of aids. Many of these aids have been added on piecemeal with quick-patch evolved configurations. It is also apparent that the aids are an extension of the aircraft carrier VLA "know how", which has emphasized precision in approach for the constant speed and constant glide slope CTOL flying requirement (drop-line lights line-up aid and glide slope indicator) rather than precision at touchdown which is essential for V/STOL and helicopter's continuously maneuvering flight. From the standpoint of flying qualities, the following considerations in the V/STOL VLA development are pertinent:

- The lower weather minima of the project goal require increased VLA performance at visual threshold. For varying operational visual threshold ranges, VLA performance requirements for corresponding flying tasks must be met.

- VLA signals must conform to V/STOL and helicopter peculiar, optimized flight paths.

- The pilot's field-of-view limitations and precision final landing maneuvering cue requirements demand closer interface with (smoother transition from) and/or direct use of electronic guidance signals in the VLA design.

C. DEVELOPMENT OF VLA REQUIREMENTS

The development of NAVTOLAND VLA requirements commenced in 1974 by NAEC under contract N68335-75-C-2120 with Pacer Systems Corporation. A Task I report of October 1975 discussed the human factors involved in receiving, processing and responding to visual information in the operational environment; the characteristics of vertical take-off and landing aircraft; and the nature of the visual task from the pilots viewpoint. Of particular importance, the Task I report:

- Identified logical segments of the approach and landing flight phase, major piloting tasks within these segments, and the information required to conduct these tasks (see Section V).

- Analyzed the improved LAMPS VLA suite to identify the level and type of information which individual component and groups of components in that suite rendered in daylight, twilight, and nighttime, for each approach and landing segment.

- Compared the information rendered by the LAMPS VLA suite in the nighttime scenario to the information requirements identified for individual approach and landing segments.

A sample Pilot Information Requirements Matrix, prepared as a result of the methodology developed above, is illustrated in Figure I-1.

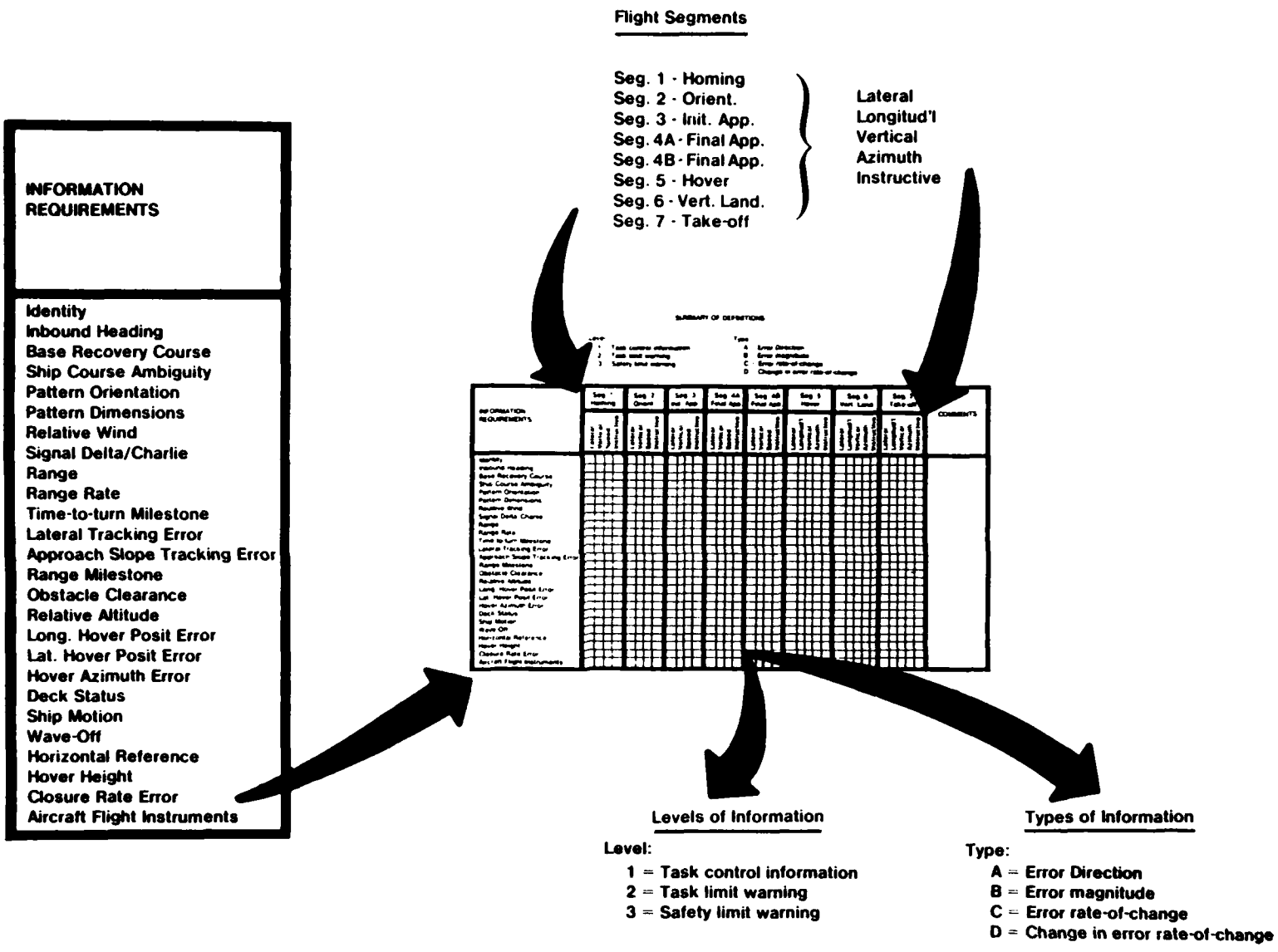

Figure I-1. Sample Pilot Information Requirements Matrix

The Pacer Systems Corporation effort continued under contract N68335-76-C-2244 and was reported in May 1976 with a Task II report which discussed display requirements. This report identified the major characteristics of VLA devices, related the major characteristics to the VLA requirements, discussed the information requirement categories, outlined the parameters of a VLA devices specification, and described the desired qualities of devices related to each information requirement category.

D. VALIDATION OF PILOT INFORMATION REQUIREMENTS

A validation by Fleet pilots of the information categories and, more specifically, particular information requirements suggested in the Pacer Systems Corporation report, was directed by the project office in 1976. The effort was conducted jointly by Pacer Systems Corporation under contract N68335-76-C-2244 and Quanta Systems Corporation under contract N68335-77-C-1092, and consisted of four tasks:

1. Development of Briefing Materials. Briefing materials were prepared for indoctrinating pilots as to the terms and considerations used in the Information Requirements Matrix. The indoctrination material consisted of:

   a. Briefing narrative with definitions of each term used on the matrix and a discussion of special considerations.

   b. Briefing aids including transparencies and handouts.

2. Development of Pilot Questionnaires. A questionnaire was prepared for the purpose of collecting data pertaining to individual pilot aeronautical qualifications, and registering pilot opinions as to the nature of information requirements. The form for recording the general and aeronautical experience of each pilot included such data as *pilot name, squadron type, amount and kind of flight experience, type of aircraft flown,* etc.

3. Pilot Interviews. The following activities designated by the NAVAIRSYSCOM were visited in 1976:

Date	Activity	Location
11/4	NATC	Patuxent River, MD
11/8	COMHELSEACONWINGONE	NAS Norfolk, VA
11/9	HSL-30, 32, 34	NAS Norfolk, VA
11/10	HM-12	NAS Norfolk, VA
11/11	HC-6	NAS Norfolk, VA
11/22	MAG-32	MCAS Cherry Point, NC
11/23	MAG-29	MCAS New River, NC
11/24	MAG-26	MCAS New River, NC
11/29	HSL-31, 33, 35	NAS North Island, CA
11/30	HC-3	NAS North Island, CA
12/2	MAG-16	MCAS Santa Ana, CA
12/3	DET MAG 16	MCAS Camp Pendleton, CA
12/10	MCAF Quantico	MCDEC Quantico, VA

A lecture of 50 minutes' duration was presented to explain the concepts, terms and considerations of the analysis which had created the Pilot Information Requirements Matrix. The pilots were then requested to make their entries on the forms provided. The forms duplicated the data on the matrices and provided spaces for interviewees to enter changes, comments, additional Information Categories, or enter categories of their own design. The interviewers requested that pilots arrange themselves into groups for mutual discussion of the issues and procedures involved with each information item. As the process began, it was necessary to go through the form, item-by-item, bringing out the relevant considerations: of environment -- black night, no horizon, EMCON; of location as based upon segment definitions; of the need to think only about the kinds of information for specific navigational task management, or safety purposes, without trying to envision the feasible means to visually provide the information (they were not to invent -- only to provide a documentation of required information); and of the concepts serving as the definition of information Levels and Types. Within a short time, the groups, of from 3 to 6 pilots, became self-sustaining in their completion of the forms and could proceed at their own pace. The group interview process was generally completed within two hours.

4. Pilot Data Tabulation. Data collected as a result of the pilot interviews was organized and tabulated to reveal the degree of concurrence with the information requirements suggested on the questionnaire. A tabulation of the survey data is presented in Section VI- Pilot Survey of Information Requirements, and Section VII- Pilot Survey Statements.

a. Pilot Survey of Information Requirements - includes a list of the information requirement categories, the ratings suggested to and by the pilots, the number of pilots which agreed or disagreed with each rating, pilot comments associated with a particular rating and engineering comments regarding differences in levels and types of data noted by the pilots. The ratings were annotated with a combination of a circle to indicate that the rating was suggested on the pilot questionnaire by the analyst, a triangle to indicate that the rating was added by the pilot, or a square to indicate that the rating was validated.

b. Pilot Survey Statements - includes the responses to general questions regarding the visual cue sources used during night operations, the adequacy of the present VLA suites and recommendations for improving the VLA.

E. ANALYSIS OF INFORMATION REQUIREMENTS

The analysis of information requirements commenced in September 1978 by Quanta Systems Corporation under NAEC contract N68335-78-C-2022. The analysis involved a tabulation of pilot concurrence with information requirements derived from the validation survey; the evaluation of information sources based on approach profiles and ranges which the sources were visible under different atmospheric conditions; and level and type of cues provided by the sources as compared to the information requirements.

1. Approach Profiles. Typical helicopter and AV-8 approaches during both VFR and IFR conditions used in accordance with NWP-42 and NWP-63 and correlated with

the homing orientation, initial approach, final approach, hover and vertical landing segments defined in the study. This enabled assignment of quantitative range values to each segment aid; thus, assessment of the effectiveness of existing sources of visual information at specific phases of the approach.

2. Information Sources. The major sources evaluated for their potential in providing the desired information requirements included: electronic aids, i.e., TACAN, radar, and voice communications; the homing beacon; view of the ship or field; ships wake; deck status lights, wave-off lights; wind sock; landing line-up lights and markings; glide slope indicators; view of the horizon; visual signals; view of obstructions; view of hangar and forward structure; and the LSE/LSO. Typical lighting configurations for LPH/LHA ships, air capable ships and 600' SATS fields are diagrammed in Section VIII.

3. Visual Range of Lights. The visual range of lights, such as the homing beacon, were evaluated under different meteorological conditions on the basis of the data indicated in Figure I-2 for day and I-3 for night. Using this data, the sources of information were rated as strong, moderate, weak, very weak or as no source. The homing beacon, for example, with an intensity of 1,500 candelas was rated as a strong source at night with 7 mile visibility assuming the pilot had closed to within a few miles of the ship. During the day, however, with the pilot at the same distance from the ship, the homing beacon was rated as no source because it could only be sited when the pilot closed to within approximately 1 mile of the ship.

4. Levels and Types of Data. The system for classifying information by level I, task control; level II, task limit warning; level III, safety limit warning; and Type A, error direction; Type B, error magnitude; Type C, error rate of change; Type D, rate in error rate of change, is described in some detail in Section V, Terminology.

Although the concept of information levels is relatively straightforward, the concept of information types required repeated explanation during the validation survey and is, therefore, further explained here.

a. In order to close to a desired approach path, or point, and thereafter to remain on the desired path, or at the desired point, three conditions must be simultaneously satisfied: first, the displacement of the aircraft from the desired path, or point (the error magnitude), must be zero; second, the rate of change of displacement (error) must be zero; and third, the rate of change of rate of change of error magnitude must be zero.

b. Rate of change of error can be obtained either indirectly by making periodic observations of error magnitude and (mentally) computing the rate of change or by direct indications of the rate of change of error. Thus, a pilot can fly an aircraft by holding the altitude nearly constant and observing only the altimeter or he can hold the altitude more nearly constant by using both the vertical speed indicator and the altimeter. Similarly, the pilot can determine rate of rate of change by direct or indirect observations.

The question as to whether a device or system yields error magnitude, rate of change of error, and rate of rate of change is dependent not only on the sensitivity of the

VISUAL RANGE OF LIGHTS AS A FUNCTION OF INTENSITY

DAY

Meteorological Visibility*	300 feet	700 feet	1/2 mile	1 mile	3 miles	7 miles
Intensity (candelas)	Daytime Visual Range (feet)					
10	200	290	420	460	500	520
60	300	470	810	980	1160	1230
100	330	530	970	1190	1460	1570
1000	480	850	1840	2560	3700	4400
10000	650	1220	3000	4500	7900	10000
100000	830	1630	4380	7080	14000	22000
10^6	1020	2050	5890	9940	22000	37000
10^7	1220	2500	7500	13000	30000	56000
10^8	1420	3000	9170	16000	40000	76000
10^9	1620	3430	10900	20000	49000	98000
(10^{20})	(4000)	(8900)	(31000)	(320000)		

* $\tau = 0.05$

Figure 1-2. Visual Range of Lights as a Function of Intensity - Day

VISUAL RANGE OF LIGHTS AS A FUNCTION OF INTENSITY

NIGHT

Meteorological Visibility*	300 feet	700 feet	1/2 mile	1 mile	3 miles	7 miles
Intensity (candelas)	Nighttime Visual Range (feet)					
10	270	550	1630	2700	5400	7900
60	320	680	2150	3800	8500	14000
100	330	720	2300	4100	9400	16000
1000	400	890	3030	5600	14000	28000
10000	470	1060	3800	7300	20000	42000
100000	540	1240	4600	9000	26000	59000
10^6	610	1430	5400	11000	33000	77000
10^7	680	1610	6200	13000	39000	95000
10^8	760	1800	7100	15000	46000	110000
10^9	830	1990	7900	17000	53000	130000
(10^{20})	(1670)	(4200)	(18000)	(38000)	(130000)	(360000)

* U.S. scale of night visibility

Figure 1-3. Visual Range of Lights as a Function of Intensity - Night

system but also upon the time available for observing the device or system and the frequency with which it can be observed. In this regard, it is easier to obtain information on the rate of change of a variable from an indication of the magnitude of the variable when the indication is of the analog type (a pointer on a meter) than when the information is digital, assuming the device indicating the magnitude is sufficiently sensitive so that one can see movement of the pointer at a glance when the rate of change is significant.

Based on the information requirements identified by the pilots during each segment of the approach profile and the evaluation of the effectiveness of existing sources in providing required information, a comparison was made which resulted in the identification of deficiencies. These deficiencies provided the guidelines for determining the performance of required visual landing aids discussed in Section IV.

SECTION II. HELICOPTER ANALYSIS

This section is divided into three parts. The first part addresses Segment 1 - homing, Segment 2 - orientation, and Segment 3 - initial approach, and requires visual aids which are visible at long range. The second part deals with Segment 4 - final approach and requires visual aids which are visible at a moderate range of about 3 miles. The third part deals with those requirements involving the hover and vertical landing and requires visual aids which provide the necessary cues during the close-in 700' to landing. The analysis conducted in each part begins with a scenario of the operation, the pilot information requirements, evaluation criteria, evaluation of existing sources of information and the identification of deficiencies.

The homing, orientation, initial approach, final approach, hover and vertical landing segments are identified in Figure 2-1 for a typical helicopter approach to an air capable ship.

PART I. HOMING, ORIENTATION AND INITIAL APPROACH

A. SCENARIO

The homing, orientation and initial approach segments are generally defined as follows:

- The homing segment includes the progress to any point from which the pilot undertakes a course to the marshalling position. The marshalling position is a point in space established relative to the ship from which approach procedures such as those using TACAN or radar services, are commenced. If the homing segment is navigated using an approach aid to reach the marshalling position or a holding point directly, the entire portion of the flight to such a position is considered to be in the homing segment. The homing section terminates as the ship is overflown, or, in the instance when the aircraft goes directly to marshall, when marshall is reached.

- The orientation segment includes the localized relative navigation undertaken to reach the marshalling position once the aircraft has arrived in the general area of the terminal site. Included in this segment are any holding or Delta patterns prescribed for control of the aircraft awaiting clearance for an approach.

- The initial approach segment begins upon departure from any marshalling position, holding point, or Delta pattern, and terminates upon completion of adjustments to the direction of flight, altitude and air speed necessary for establishing final approach conditions. For aircraft flying a "racetrack" pattern, this segment includes the up-wind leg of 300 feet on the starboard side of the ship, formation break for landing interval, and the downwind leg to the 180 degree position.

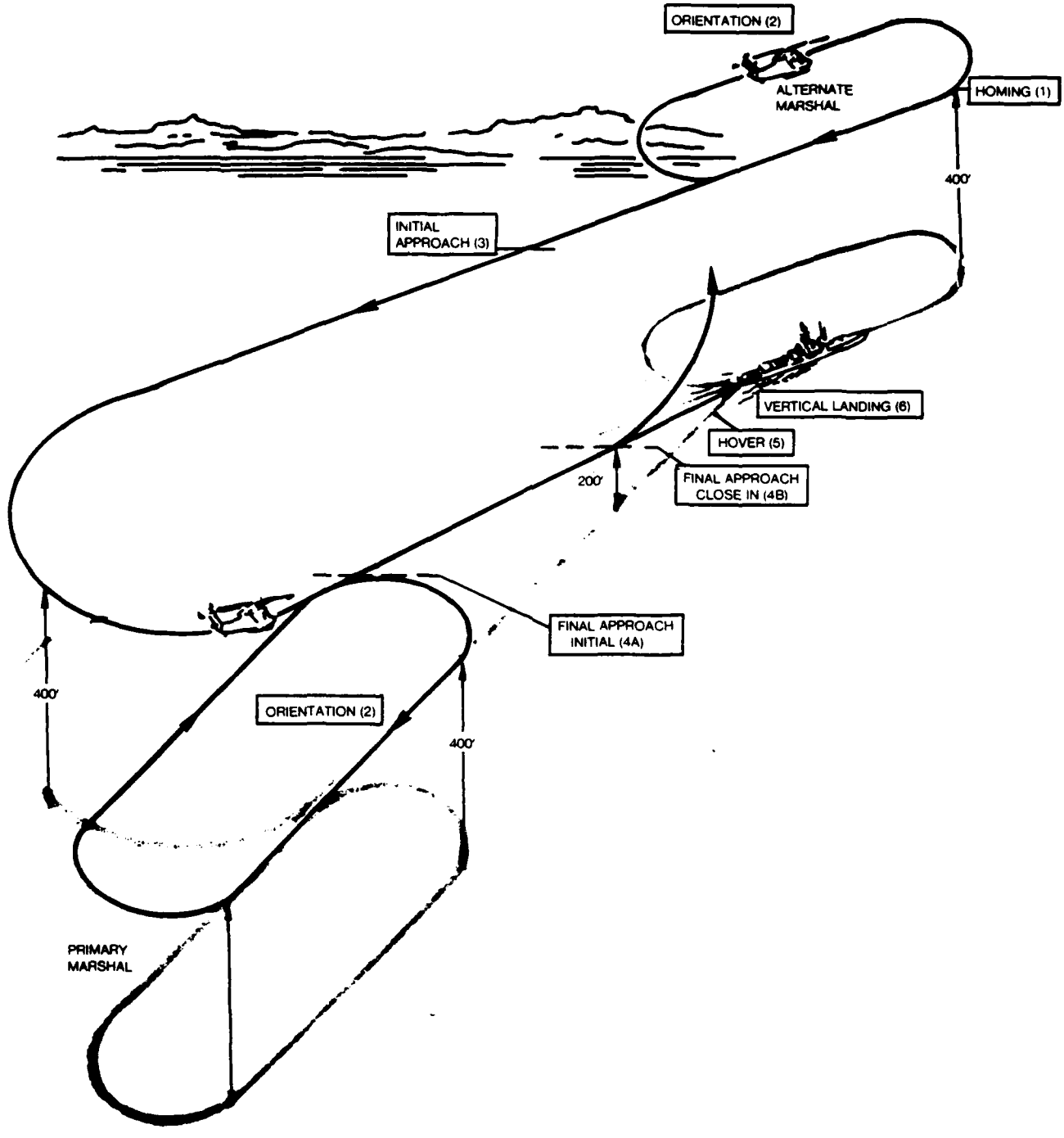

Figure 2-1. Typical Air Capable Ship Landing Pattern for Helicopters
Approach Profile for Helicopters

B. PILOT INFORMATION REQUIREMENTS

The data contained in Figure 2-2 for the homing segment indicates the percentage of Navy and Marine pilots operating both at sea and on shore which agree to the information requirements suggested in the survey. In reviewing the percentages, it appears that there is substantial agreement among the pilots with regard to requiring:

1. Identity and inbound heading data to locate the ship.

2. Ships course ambiguity, base course recovery, pattern orientation, pattern dimensions, and signal Delta/Charlie data to determine the correct orientation to the ship.

3. Range and range rate data to determine the point at which to start the initial approach.

4. Deck status, relative wind and ship motion data to determine the situation aboard ship.

A few noteworthy exceptions are discussed below.

1. Identity - 78% of the VERTREP pilots indicated the need for task limit warning as opposed to task control information. These pilots commented that fuel was particularly critical on long missions and were, thus, more concerned than other pilots in locating the ship immediately.

2. Ship Motion - This information seems to be important in the minds of many pilots, even at the homing segments, in order that they may mentally prepare themselves for the task ahead. In addition, it appears that interest in ship motion appears to grow as the size of the ship diminishes.

3. VERTREP Load Data - Many H-46 pilots suggested the need to be aware of this data as a prerequisite for any flight.

4. Aircraft Separation - Although just a few pilots indicated the need to be aware of aircraft separation, it is noted here because of the importance of this information during multi-aircraft operations.

5. Landing Area Size and Shape - This information was only requested by one pilot. It is considered significant to note because, like ship motion, pilots are often interested in gaining as much information prior to the time that it is required in order to reduce the anxiety level.

During the orientation and initial approach segments, the information required by pilots remained generally the same, except as noted:

1. Identity, inbound heading, and ships course ambiguity information was not required since it had already been established during the homing segment.

Information Requirements	Type	U.S. Navy At Sea					Marines At Sea			Marines At Sea and Shore
		H-2 (Note 1)	H-46 (Note 2)	H-46 (Note 3)	H-53 (Note 4)	H-53 (Note 5)	UH-1/AH-1 (Note 6)	H-46 (Note 7)	H-53 (Note 8)	H-1/H-46/H-53 (Note 9)
Identity	Instructional - Task Control	50%		57%	100%	100%	89%	47%	33%	71%
Identity	Instructional - Task Limit Warning		78%							
Inbound Heading	Lateral - Task Control	89%	100%	100%	100%	100%	96%	74%	83%	71%
Ships Course Ambiguity	Instructional - Task Control	61%	100%	100%	100%	100%	100%	89%	75%	90%
Base Course Recovery	Instructional - Task Control	78%	100%	100%	100%	100%	100%	89%	83%	87%
Pattern Orientation	Instructional - Task Control	78%	89%	71%	100%		100%	79%	92%	87%
	Lateral - Task Control - Error Magnitude					100%				
Pattern Dimensions	Instructional - Task Control	78%	100%	100%	100%		100%	100%	92%	92%
Relative Wind	Instructional - Task Control	83%	100%	86%	100%		96%	89%	100%	87%
	Lateral - Task Control - Error Magnitude					100%				
Signal Delta Charlie	Instructional - Task Control	72%	67%	71%	100%	100%	100%	100%	83%	94%
Range	Instructional - Task Control	88%	100%	100%	100%	100%	96%	84%	100%	88%
Range Rate	Instructional - Task Control	88%	100%	100%	100%	100%	100%	94%	100%	94%
Time-to-turn Milestone	Instructional - Task Control					100%				
Deck Status	Instructional - Task Control	78%	100%	100%	100%		100%	84%	83%	90%
Ship Motion	Instructional - Task Control	33%	22%	29%			18%	5%		8%
VERTREP Load Data	Instructional - Task Control		22%	71%						
Aircraft Separation	Instructional - Task Control							5%		2%
Loading Zone Size & Shape	Instructional - Task Control									2%
Lateral Tracking Error	Lateral - Task Limit - Error Magnitude					100%				
Approach Slope Tracking Error	Instructional - Task Control					100%				
Relative Altitude	Instructional - Safety Limit Warning					100%				
Horizontal Reference	Lateral - Speed/Long'l - Task Limit - Rate of Change					100%				
Closure Rate	Speed/Long'l - Task Control - Error Magnitude					100%				

Note 1 - H-2 Operating from Combatants; Sample size 19 (See Figure 6-1 series)
Note 2 - H-46 Operating from Auxiliaries; Sample size 9 (See Figure 6-4 series)
Note 3 - H-46 Operating from Combatants; Sample size 7 (See Figure 6-5 series)
Note 4 - H-53 Operating from LPD's; Sample size 3 (See Figure 6-6 series)
Note 5 - H-53 MK 105 Sled; Sample Size 4 (See Figure 6-8 and 6-9 series)
Note 6 - UH-1/AH-1 Operating from LPH/LHA; Sample size 28 (See Figure 6-10 series)
Note 7 - H-46 Operating from LPH/LHA; Sample size 19 (See Figure 6-11 series)
Note 8 - H-53 Operating from LPH/LHA; Sample size 12 (See Figure 6-12 series)
Note 9 - H-1/H-46/H-53 Operating from LPH/LHA and Shore Bases; Sample size 52 (See Figures 6-13/14/15/16 series)

Figure 2-2. Helicopter Pilot Concurrence with Information Requirements - Homing, Orientation and Initial Approach Segments

2. Some pilots conducting VERTREP operations often fly an abbreviated approach pattern as compared with a normal landing and, thus, start to desire information, such as obstacle clearance, relative altitude, hover height, closure rate and wave-off information, during the initial approach segment rather than the final approach.

3. Some pilots landing on shore facilities desired information such as approach slope tracking error, obstacle clearance and relative altitude because they were concerned about contacting obstructions.

C. EVALUATION CRITERIA

In order to evaluate potential sources for homing, orientation and initial approach, some criteria had to be established with regard to the distance and altitude of the aircraft from the ship. For this reason two values were assigned. The first value pertains to the distance the helicopter pilot could be expected to fly to the ship without the assistance of navigational aids under EMCON conditions. The value selected for this condition was 3 miles and assumes that the pilot would execute a square search pattern if he does not initially locate the ship. The second value pertains to the distance the helicopter pilot could be expected to fly to the ship with the assistance of navigational aids. The value selected for this condition was assumed to be 1 mile.

Although the pilot normally commences the homing segment at an altitude of 400' to 500', it was assumed that under EMCON conditions the pilot would fly beneath whatever ceiling existed even if IFR conditions prevailed.

D. EVALUATION OF EXISTING SOURCES

The four sources of information considered essential in the homing, orientation and initial approach segments are rated in Figure 2-3 and discussed below:

1. Electronic Aids - including TACAN, radar and voice communications are strong sources of information for both identifying the ship and determining inbound heading, base course recovery and ships course.

Electronic aids were considered not applicable during EMCON conditions.

2. Homing Beacon - The existing homing beacon with 1,500 candelas provides a strong source at night with 7 mile visibility and, with electronic aids used to close within 1 mile of the ship, a strong source with 1 mile visibility. The homing beacon is not, however, visible during all other conditions. During the day, with 7 mile visibility, for example, the homing beacon cannot be seen even when the helicopter is within 1 mile of the ship. The situation is further complicated as the visibility minimums are reduced. The homing beacon was rated not applicable during IFR conditions with electronic aids because the pilot is flying instruments and not using any external visual sources.

REQUIREMENT							EVALUATION																					
	LEVEL/TYPE							LEVEL/TYPE																					
								VFR								IFR												
								NORMAL 7 MI. VIS				SPECIAL 1 MI. VIS				NORMAL ½ MI. VIS				EMERGENCY 300 FT. VIS.				NAVTOLAND 700 FT. VIS.			
								DAY		NIGHT		DAY		NIGHT		DAY		NIGHT		DAY		NIGHT		DAY		NIGHT	
INFORMATION	LATERAL	LONG./SPD.	VERTICAL			INSTRUCT.	SOURCE	EA	E	EA	E	EA	E	EA	E	EA	E	EA	E	E	E	E	E	EA	E	EA	E
Identity						1	Homing Beacon	NV	NV	1+	1+	NV	NV	1+	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV
							View of Ship	1+	1+	1+	1	1-	NV	1-	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV
							Ships Wake	1+	1+	NV	NV	1	NV	NV	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV
							Electronic Aids	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA
Inbound Heading	1B						Homing Beacon	NV	NV	1B+	1B+	X	NV	1B+	X	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV
							View of Ship	1B+	1B+	1B+	1B	1B-	NV	1B-	X	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV
							Ships Wake	1B+	1B+	NV	NV	1B	NV	NV	X	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV
							Electronic Aids	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA
Remaining VFR ratings are based on pilot having found ship and flying to it.																												
Base Recovery Course						1	View of Ship	1+	1+	1	1	1+	1+	1	1	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV
							Ships Wake	1+	1+	NV	NV	1	NV	NV	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV
							Electronics Aids	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA
							Visual Signals *	NA	1	NA	1	NA	1	NA	1	NA	1	NA	1	NA	1	NA	1	NA	1	NA	1
Ships Course Ambiguity						1	View of Ship	1+	1+	1	1-	1-	NV	1-	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV
							Ships Wake	1+	1+	NV	NV	1	NV	NV	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV
							Electronic Aids	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA
Pattern Orientation						1	Electronic Aids	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA
							Visual Signals *	NA	1	NA	1	NA	1	NA	1	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV

* Visual signals are not currently used to provide this information.
Not Applicable (NA); Not Visible (NV); Electronic Aids (EA); EMCON (E); strong source (+); weak source (-); very weak source (=); moderate source (blank)

Figure 2-3. Evaluation of Existing Information Sources for Helicopters - Homing, Orientation and Initial Approach Segments

REQUIREMENT						EVALUATION																				
	LEVEL/TYPE						LEVEL/TYPE																			
							VFR								IFR											
							NORMAL 7 MI. VIS.				SPECIAL 1 MI. VIS.				NORMAL ½ MI. VIS.				EMERGENCY 300 FT. VIS.				NAVTOLAND 700 FT. VIS.			
							DAY		NIGHT		DAY		NIGHT		DAY		NIGHT		DAY		NIGHT		DAY		NIGHT	
INFORMATION	LATERAL	LONG./SPD.	VERTICAL		INSTRUCT.	SOURCE	EA	E	EA	E	EA	E	EA	E	EA	E	EA	E	EA	E	EA	E	EA	E	EA	E
Pattern Dimension					1	Electronic Aids	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA
						Visual Signals *	NA	1	NA	1	NA	1	NA	1	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV
Relative Wind					1	Electronic Aids	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA
						Visual Signals *	NA	1	NA	1	NA	1	NA	1	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV
Signal Delta/Charlie					1	Electronic Aids	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA
						Visual Signals	NA	1	NA	1	NA	1	NA	1	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV
Range					1	Electronic Aids	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA
						View of Ship	1	1	1-	1-	1	1	1-	1-	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV
						Ships Wake	1	1	NV	NV	1-	NV	NV	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV
Range Rate					1	Electronic Aids	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA
						Visual Signals *	NA	1	NA	1	NA	1	NA	1	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV
Deck Status					1	Electronic Aids	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA
						Visual Signals	NA	1	NA	1	NA	1	NA	1	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV
Ship Motion					1	Electronic Aids	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA	1+	NA
						Visual Signals *	NA	1	NA	1	NA	1	NA	1	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV	NA	NV

* Visual signals are not currently used to provide this information.
Not Applicable (NA); Not Visible (NV); Electronic Aids (EA); EMCON (E); strong source (+); weak source (-); very weak source (=); moderate source (blank)

Figure 2-3. Evaluation of Existing Information Sources for Helicopters - Homing, Orientation and Initial Approach Segments (continued)

3. View of Ship - The view of the ship provides a strong source during the day with 7 mile visibility. The source deteriorates to a weak source during the day with 1 mile visibility and was rated as not visible under EMCON since the pilot was, by definition, only able to fly within 3 miles of the ship and, therefore, could not see the ship with 1 mile visibility.

At night, the view of the ships navigational lights were rated as a strong source of identity information with 7 mile visibility and the aircraft 1 mile from the ship, and a moderate source with 7 mile visibility and the aircraft at 3 miles from the ship. With 1 mile visibility, however, the view of the ship at night was rated as a weak source at 1 mile and was, of course, not visible under EMCON with the aircraft at 3 miles from the ship.

During IFR conditions, the view of the ship was considered not applicable since the pilot was on instruments and due to the minimums (less than $\frac{1}{2}$ mile visibility) would not see the ship when 1 mile away.

During EMCON conditions, the pilot is presumed to be only within 3 miles of the ship and would be unable to see the view of the ship with visibility minimums of $\frac{1}{2}$ and less miles.

4. Ships Wake - Provides a strong source for identifying the ship during the day under 7 mile visibility and a moderate source during the day under 1 mile visibility. The ships wake is not visible under all other conditions.

E. DEFICIENCY

A summary of the most highly rated visual sources contained in Figure 2-3 are listed in Figure 2-4, excluding any form of electronic aid or visual signals. Based on an analysis of the summary data, the following conclusions can be drawn.

1. Under IFR conditions, the pilot can accomplish the homing, orientation and initial approach segments only with the use of electronic aids. Should the aids not be available or if the ship is operating under EMCON conditions the pilot can be, for the purposes of this study, considered under VFR conditions.

2. Except for VFR conditions with the visibility above 3 miles, the pilot is unable to acquire the ship and determine inbound heading.

3. The pilot may, after acquiring a ship, experience difficulty in differentiating the ships from other ships in the operating area.

4. No visual methods currently have been devised to communicate necessary data on base course recovery, ship course ambiguity, pattern orientation, pattern dimensions, relative wind, signal Delta/Charlie, range, range rate, deck status and ship motion under EMCON conditions.

INFORMATION REQUIREMENT	LEVEL/TYPE					Information Provided									
						Condition									
						Day					Night				
						VFR		IFR			VFR		IFR		
	LATERAL	LONG./SPD.	VERTICAL	AZIMUTH	INSTRUCT.	7 mi	1 mi	1/2 mi	700 ft	300 ft	7 mi	1 mi	1/2 mi	700 ft	300 ft
Identity *					1	1+	NV	NV	NV	NV	1+	NV	NV	NV	NV
Inbound Heading *	1B					1B+	NV	NV	NV	NV	1B+	NV	NV	NV	NV
Base Recovery Course *					1	1+	1	NV	NV	NV	NV	NV	NV	NV	NV
Ship Course Ambiguity *					1	1+	1-	NV	NV	NV	1-	1-	NV	NV	NV
Pattern Orientation *, **					1	1	1	NV	NV	NV	1	1	NV	NV	NV
Pattern Dimensions *, **					1	1	1	NV	NV	NV	1	1	NV	NV	NV
Relative Wind*, **					1	1	1	NV	NV	NV	1	1	NV	NV	NV
Signal Delta/Charlie *					1	1	1	NV	NV	NV	1	1	NV	NV	NV
Range *, **					1	1	1	NV	NV	NV	1-	1-	NV	NV	NV
Range Rate *, **					1	1	1	NV	NV	NV	1	1	NV	NV	NV
Time-to-turn Milestone															
Lateral Tracking Error															
Approach Slope Tracking Error															
Range Milestone															
Obstacle Clearance															
Relative Altitude															
Longitudinal Hover Position															
Lateral Hover Position															
Hover Azimuth Error															
Deck Status *					1	1	1	NV	NV	NV	1	1	NV	NV	NV
Ship Motion *, **					1	1	1	NV	NV	NV	1	1	NV	NV	NV
Wave off															
Horizontal Reference															
Hover Height															
Closure Rate Error															
Aircraft Flight Instruments															

* Excludes use of Electronic Aids
** Visual signals are not currently used to provide this information

Not Visible - NV
Strong source - +
Moderate source - blank
Weak source - -
Very weak source - =

Figure 2-4. Summary of Information Required Versus Information Provided for Helicopters - Homing, Orientation and Initial Approach Segments

PART II. FINAL APPROACH

A. SCENARIO

The final approach involves, for purposes of this study, pilot-controlled adjustments to flight direction, altitude and air speed which are necessary to maintain the desired flight path and speed relative to the terminal site. The segment terminates once the transition to hovering flight is undertaken. The final approach segment is the leg within which landing site facilities become the primary source of visual information for task control. There is a continuity of pilot tasks throughout this segment. Hence, it is treated as an entity; however, the transition from primarily flight-instrument-means to visual site reference warrants a subdivision of this segment. For this reason, the final approach segment is considered in two parts: Segment 4A -- the initial portion of the final approach commencing at about 3 miles and terminating at roughly 200 feet and $\frac{1}{2}$ mile; and Segment 4B -- the close-in part of the final approach, commencing at $\frac{1}{2}$ mile and terminating at the point when the transition to hover is begun.

For aircraft flying the "racetrack pattern", the final approach segment involves pilot-controlled adjustments to flight direction, altitude and speed to make the turn and descent to intercept the extension of the 45 degree "spike" on the designated landing spot, at which time the segment is terminated. The initial final approach includes all progress to the 45 degree position, and the close-in portion comprises the functions to the point at which the "spike" from the landing spot is intercepted.

B. PILOT INFORMATION REQUIREMENTS

A review of the data contained in Figure 2-5 indicates the information required by the pilots surveyed for the initial and final segments of the final approach. In reviewing the percentages derived, it appears that there is substantial agreement among all pilots in most of the information requirements. Pilots generally agreed that the following information was required:

1. Instructional task control data for determining base recovery course, relative wind and ship motion.

2. Instructional task control data during initial final approach and instructional safety limit warning data during final approach for determining range milestone, deck status and wave-off.

3. Approach slope tracking error, and lateral tracking error for determining rate of change and safety limit warning.

4. Closure rate error data for determining error magnitude.

5. Horizontal reference for determining error rate of change.

Information Requirements	Type	U.S. Navy At Sea				Marines At Sea			Marines at Sea & Shore
		H-2 (Note 1)	H-46 (Note 2)	H-46 (Note 3)	H-53 (Note 4)	UH-1/AH-1 (Note 5)	H-46 (Note 6)	H-53 (Note 7)	H-1/H-46/H-53 (Note 8)
Base Recovery Course	Instructional - Task Control	/95%			/100%	11%/100%	/100%		/90%
Relative Wind	Instructional - Task Control	72%/70%	89%/88%	57%/71%	100%/100%	96%/96%	74%/84%	75%/73%	84%/72%
Lateral Tracking Error	Lateral - Task Limit Warning - Error Magnitude	100%/100%	100%/100%	100%/	[illegible] /100%	100%/100%	100%/100%	83%/91%	74%/86%
Lateral Tracking Error	Lateral - Task Limit Warning - Rate of Change			/100%					6%/
Approach Slope Tracking Error	Vertical - Safety Limit Warning - Error Magnitude	94%/	89%/	100%/	100%/	96%/	89%/	83%/	71%/
Approach Slope Tracking Error	Vertical - Safety Limit Warning - Rate of Change	/100%	/100%	/100%	/100%	/100%	/95%	/100%	10%/86%
Range Milestone	Instructional - Task Control	89%	100%/	100%/	100%/	100%/	95%/	83%/	90%/
Range Milestone	Instructional - Task Limit Warning	/90%	/100%	/100%	/100%	/96%	/95%	/91%	/86%
Deck Status	Instructional - Task Control	78%/75%	100%/	100%	100%/100%	100%/89%	58%/63%	83%/73%	90%/74%
Deck Status	Instructional - Safety Limit Warning		/88%	100%					
Ship Motion	Instructional - Task Control	28%/35%							
Wave Off	Instructional - Task Control	83%/	100%/	86%	100%/	100%/	74%/	83%/	77%/
Wave Off	Instructional - Safety Limit Warning	/100%	/100%	/100%	/100%	/100%	/100%	/100%	/90%
Horizontal Reference	Lateral - Speed Longitudinal - Task Control - Error Rate of Change	/100%	/100%	/100%		/100%	/95%		/86%
Closure Rate Error	Speed/Longitudinal - Task Control - Error Magnitude	89%/65%	78%/63%	71%/	100%/	100%/82%	68%/58%	66%/55%	71%/45%
Closure Rate Error	Speed/Longitudinal - Task Limit Warning - Error Magnitude			/71%	/100%				6%/14%

Note 1 - H-2 Operating from Combatants, Sample Size 18 pilots Segment 4A and 20 pilots Segment 4B. (See Figure 6-1 series)
Note 2 - H-46 Operating from Auxiliaries, Sample Size 9 pilots Segment 4A and 8 pilots Segment 4B. (See Figure 6-4 series)
Note 3 - H-46 Operating from Combatants, Sample Size 7 pilots Segments 4A and 4B. (See Figure 6-5 series)
Note 4 - H-53 Operating from LPD's, Sample Size 3 pilots Segments 4A and 4B. (See Figure 6-6 series)
Note 5 - UH-1/AH-1 Operating from LPH/LHA's, Sample Size 28 pilots Segments 4A and 4B. (See Figure 6-10 series)
Note 6 - H-46 Operating from LPH/LHA's, Sample Size 19 pilots Segments 4A and 4B. (See Figure 6-11 series)
Note 7 - H-53 Operating from LPH/LHA's, Sample Size 12 pilots Segment 4A and 11 pilots Segment 4B. (See Figure 6-12 series)
Note 8 - H-1/H-46/H-53 Operating from LPH/LHA's and Shore Bases, Sample Size 31 pilots Segment 4A and 29 pilots Segment 4B. (See Figure 6-13, -14, -15, -16 series)

LEGEND:

Segment 4A	Segment 4B
3 mi to ½ mi	½ mi to Transition

Figure 2-5. Helicopter Pilot Concurrence with Information Requirements - Final Approach Segment

A few noteworthy exceptions are discussed below.

1. Base Recovery Course - A majority of the pilots indicated a need for base recovery course information during the final approach, presumably as a final up-date before transition to hover.

2. Range Milestone - A majority of the pilots indicated that a range milestone task limit warning was desired as they closed on the ship during the final approach.

3. Deck Status - H-46 pilots conducting VERTREP operations considered deck status information extremely important because of the difficulties in aborting the drop at the last second with an external load. In addition, the aircraft is sometimes already at maximum power and is not as maneuverable while carrying the load. Consequently, H-46 pilots indicated that they would rather make an extra trip around than take a wave-off during the hover.

4. Wave-Off - Pilots agreed they definitely wanted wave-off information before transitioning to hover.

5. Ship Motion - Information was mainly only of concern to H-2 pilots attempting to operate from combatants while conducting all-weather LAMPS operations.

6. Closure Rate - Some pilots indicated a need to obtain a task limit warning with regard to closure rate.

The number of pilots indicating a need for other types of data was, in most cases, less than 5% and attributed, in most part, to a lack of completely understanding the pilot information requirements matrix terminology. As with the homing, orientation and initial approach segments, however, many pilots operating to shore bases showed considerable concern with regard to contacting obstructions.

C. EVALUATION CRITERIA

The deck scene (line-up lights, drop-line lights, extended line-up, floodlights, perimeter lights and marking) were not rated individually because data was not collected in sufficient detail to evaluate the cues provided by individual aids except in a general sense.

The PAR is recommended for shooting approaches in conditions of less than 1 mile visibility and 500 foot ceiling. Therefore, the TACAN, ASR and ADF were not rated in Figures 2-6 and 2-7 individually as providing any source of data at the $\frac{1}{2}$ mile or less distance. Should the pilot not visually acquire the ship at a distance of $\frac{1}{2}$ mile, he is waved off. In addition, it should be noted that the PAR does not in itself provide required closure rate information because the closure rate has to be computed by measuring the current speed and distance the aircraft is from the ship and comparing that with the desired speed and distance.

D. EVALUATION OF EXISTING SOURCES

The six basic sources of information considered essential in the final approach segments are rated in Figures 2-6 and 2-7 and discussed below:

1. Electronic Aids - including TACAN, radar and voice communications were rated as a strong source in providing all required information. The electronic aids were considered not applicable, however, in EMCON conditions and were, therefore, excluded from the analysis summary.

2. Deck Status and Wave-Off Lights - the existing deck status and wave-off light systems provide a moderate source of deck status and wave-off information at night during the initial Final Approach Segment and VFR minimums. As the pilot closes to ½ mile of the ship and commences the Close-In Segment, the deck status light becomes a strong source of deck status and wave-off information.

During day VFR conditions, it is questionable as to whether or not the deck status light can be readily seen during the initial final approach, although it was rated as a moderate source during the close in portion.

During IFR conditions, the deck status light is barely visible at night with ½ mile visibility and not visible at all under day ½ mile, or day or night 300' and 700' minimums.

3. Wind Sock - Movements in the wind sock are hardly visible during the initial final approach and only provides a weak source of data during the close in portion whether it is day or night. Even when the wind sock is visible it is difficult to judge the amount of air flow through the sock since the ship is already steaming at 15 to 20+ knots. In addition, it provides an unreliable source of wind direction except when the pilot can view the wind sock from above at a close distance.

4. View of the Ship - The view of the ship hull and superstructure during the day and, homing beacon and deck lighting in relation to navigational lights at night, provide only marginal visual cues with regard to range milestone, lateral tracking error, approach slope tracking error and closure rate error. The pilot can compare the size of the ship and vertical and lateral position of the ship with respect to the aircraft's window although these cues provide more of a sense of error direction rather than error magnitude. This information comparison is, however, influenced significantly by the side slip and yaw of the aircraft. The source is generally not as good at night as it is during the day because fewer cues are provided. In addition, the ship cannot be seen at all during IFR conditions of 700' and 300' since the initial final approach commences at ½ mile. The view of the ship, however, provides a strong source during the close in portion for ship motion assuming that some horizontal reference such as the view of the ocean is also within the field of view. Some of the pilots indicated that ship motion information would be beneficial during the initial final approach in order to adequately prepare themselves for the conditions at hand. The view of the ship during the close in portion provides a moderate source during the day and only a weak source at night.

REQUIREMENT						EVALUATION													
INFORMATION	LEVEL/TYPE					SOURCE	LEVEL/TYPE												
							VFR								IFR				
							NORMAL 7 MI. VIS.				SPECIAL 1 MI. VIS.				NORMAL ½ MI. VIS.		EMERGENCY 300 FT. VIS.		NAVTOLAND 700 FT. VIS
							DAY		NIGHT		DAY		NIGHT		DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
	LATERAL	LONG./SPD.	VERTICAL	AZIMUTH	INSTRUCT.		EA	E	EA	E	EA	E	EA	E						
Relative Wind					1	Voice Communication	1+	NA	1+	NA	1+	NA	1+	NA	1+	1+	1+	1+	1+	1+
(Potential Update)						Visual Signal	NA	1	NA	1	NA	1	NA	1	NV	NV	NV	NV	NV	NV
Lateral Tracking Error	2B					Navigation Aids	NA	NA	NA	NA	NA	NA	NA	NA	1+	1+	1+	1+	1+	1+
						Line-up Lights	1A	1A	1A	1A	1A	1A	1A	1A	NV	NV	NV	NV	NV	NV
						Line-up Markings	1A	1A	NV	NV	1A-	1A-	NV	NV	NV	NV	NV	NV	NV	NV
						View of Ship	1A-	1A-	1A=	AA=	1A-	1A-	1A	1A=	NV	NV	NV	NV	NV	NV
Approach Slope Tracking Error			3B			View of Ship	1A=	1A=	1A=	1A=	1A=	1A=	1A=	1A=	NV	NV	NV	NV	NV	NV
						GSI	NV	NV	2A+	2A+	NV	NV	2A-	2A-	NV	NV	NV	NV	NV	NV
						Navigational Aids	NA	NA	NA	NA	NA	NA	NA	NA	1+	1+	1+	1+	1+	1+
Range Milestone					1	View of Ship	1	1	1-	1-	1	1	1-	1-	NV	NV	NV	NV	NV	NV
Deck Status					1	Deck Status Light	1	1	1	1	1	1	1	1	NV	NV	NV	NV	NV	NV
						Light Signal Gun	1	1	1+	1+	1	1	1+	1+	NV	NV	NV	NV	NV	NV
						Visual Signal	1	1	1	1	1	1	1	1	NV	NV	NV	NV	NV	NV
						LSE	1	1	1	1	1	1	1	1	NV	NV	NV	NV	NV	NV
						Voice Communications	1+	NA	1+	NA	1+	NA	1+	NA	1+	1+	1+	1+	1+	1+
Ship Motion					1	View of Ship	1	1	1-	1-	1	1	1-	1-	NV	NV	NV	NV	NV	NV
						Voice Communication	1+	NA	1+	NA	1+	NA	1+	NA	1+	1+	1+	1+	1+	1+

Not Applicable (NA); Not Visible (NV); Electronic Aids (EA); EMCON (E); strong source (+); weak source (-); very weak source (=); moderate source (blank)

Figure 2-6. Evaluation of Existing Information Sources for Helicopters - Initial Final Approach Segment

REQUIREMENT						EVALUATION															
INFORMATION	LEVEL/TYPE					SOURCE	LEVEL/TYPE														
							VFR								IFR						
							NORMAL 7 MI. VIS.				SPECIAL 1 MI. VIS.				NORMAL ½ MI. VIS.		EMERGENCY 300 FT. VIS.		NAVTOLAND 700 FT. VIS.	
							DAY		NIGHT		DAY		NIGHT							
	LATERAL	LONG./SPD.	VERTICAL	AZIMUTH	INSTRUCT.		EA	E	EA	E	EA	E	EA	E	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
Wave Off					1	Deck Status Light	1	1	1	1	1	1	1	1	NV	NV	NV	NV	NV	NV
						Light Signal Gun	1	1	1+	1+	1	1	1+	1+	NV	NV	NV	NV	NV	NV
						Visual Signal	1	1	1	1	1	1	1	1	NV	NV	NV	NV	NV	NV
						LSE	1	1	1	1	1	1	1	1	NV	NV	NV	NV	NV	NV
						GSI Wave-Off	1	1	1	1	1	1	1	1	NV	NV	NV	NV	NV	NV
Closure Rate Error		1B				Navigational Aids	NA	NA	NA	NA	NA	NA	NA	NA	1A	1A	1A	1A	1A	1A
						View of Ship	1A	1A	1A=	1A=	1A	1A	1A=	1A=	NV	NV	NV	NV	NV	NV

Not Applicable (NA); Not Visible (NV); Electronic Aids (EA); EMCON (E); strong source (+); weak source (-); very weak source (=); moderate source (blank)

Figure 2-6. Evaluation of Existing Information Sources for Helicopters - Initial Final Approach Segment (Continued)

REQUIREMENT						EVALUATION															
INFORMATION	LEVEL/TYPE					SOURCE	LEVEL/TYPE														
							VFR								IFR						
							NORMAL 7 MI. VIS.				SPECIAL 1 MI. VIS.				NORMAL ½ MI. VIS		EMERGENCY 300 FT. VIS.		NAVTOLAND 700 FT. VIS	
							DAY		NIGHT		DAY		NIGHT							
	LATERAL	LONG./SPD.	VERTICAL	AZIMUTH	INSTRUCT		EA	E	EA	E	EA	E	EA	E	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
Base Recovery Course					1	Voice Communications	1+	NA	1+	NA	1+	NA	1+	NA	1+	1+	1+	1+	1+	1+
Relative Wind					1	Voice Communications	1+	NA	1+	NA	1+	NA	1+	NA	1+	1+	1+	1+	1+	1+
						Wind Sock	1-	1-	1-	1-	1-	1-	1-	1-	1-	1-	NV	NV	NV	NV
Lateral Tracking Error	2B					PAR	NA	NA	NA	NA	NA	NA	NA	NA	2B+	2B+	2B+	2B+	2B+	2B+
						Line-up Lights	1C-	1C-	1C	1C	1C-	1C-	1C	1C	1C-	1C	NV	NV	NV	NV
						Line-up Marking	1C	1C	NA	NA	1C	1C	NA	NA	1C	X	NV	NV	NV	NV
						Line-up Marking Floodlighted	NA	NA	1C-	1C-	NA	NA	1C-	1C-	NA	1C-	NV	NV	NV	NV
						View of Ship	1B-	1B-	1A-	1A-	1B-	1B-	1A-	1A-	1B-	1A-	NV	NV	NV	NV
Approach Slope Tracking Error		3C				View of Ship	1B-	1B-	1A-	1A-	1B-	1B-	1A-	1A-	1B-	1A-	NA	NA	NA	NA
						PAR	NA	NA	NA	NA	NA	NA	NA	NA	2B+	2B+	2B+	2B+	2B+	2B+
						GSI	2A	2A	2A+	2+	2A	2A	2A+	2A+	NV	2A-	NV	NV	NV	NV
Range Milestone					2	View of Ship	2-	2-	1	1	2-	2-	1	1	1	1-	NV	NV	NV	NV
						PAR	NA	NA	NA	NA	NA	NA	NA		2+	2+	2+	2+	2+	2+
Deck Status					1	Voice Communications	1+	NA	1+	NA	1+	NA	1+	NA	1+	1+	1+	1+	1+	1+
						Deck Status Light	1	1	1+	1+	1	1	1	1	NV	1-	NV	NV	NV	NV
						Flag Hoist	1-	1-	NV	NV	1-	1-	NV	NV	NV	NV	NV	NV	NV	NV
						LSE	1-	1-	1-	1-	1-	1-	1-	1-	NV	1=	NV	NV	NV	NV
Ship Motion					1	View of Ship	1+	1+	1	1	1+	1+	1	1	1-	1-	NV	NV	NV	NV

Not Applicable (NA); Not Visible (NV); Electronic Aids (EA); EMCON (E); strong source (+); weak source (-); very weak source (=); moderate source (blank)

Figure 2-7. Evaluation of Existing Information Sources for Helicopter - Close-In Final Approach Segment

REQUIREMENT							EVALUATION													
	LEVEL/TYPE						LEVEL/TYPE													
							VFR								IFR					
							NORMAL 7 MI. VIS.				SPECIAL 1 MI. VIS.				NORMAL ½ MI. VIS.		EMERGENCY 300 FT. VIS.		NAVTOLAND 700 FT. VIS	
							DAY		NIGHT		DAY		NIGHT							
INFORMATION	LATERAL	LONG./SPD	VERTICAL	AZIMUTH	INSTRUCT.	SOURCE	EA	E	EA	E	EA	E	EA	E	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
Wave-Off					3	Wave-Off Light	3+	3+	3+	3+	3	3	3+	3+	3-	3	NV	NV	NV	NV
						Voice Communications	3+	NA	3+	NA	3+	NA	3+	NA	3+	3+	3+	3+	3+	3+
						LSE	1-	1-	1-	1-	1-	1-	1-	1-	NV	1=	NV	NV	NV	NV
						Deck Status Light	1	1	1+	1+	1	1	1+	1+	NV	1-	NV	NV	NV	NV
Horizontal Reference	1C	1C				View of Ocean	1C+	1C+	1C-	1C-	1C	1C	1C=	1C=	NV	NV	NV	NV	NV	NV
Closure Rate Error		1B				PAR	NA	NA	NA	NA	NA	NA	NA	NA	1A	1A	1A	1A	1A	1A
						View of Ship	1B	1B	1A-	1A-	1B	1B	1A-	1A-	1A	NV	NV	NV	NV	NV
						Doppler Ground Speed	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Not Applicable (NA); Not Visible (NV); Electronic Aids (EA); EMCON (E); strong source (+); weak source (-); very weak source (=); moderate source (blank)

Figure 2-7. Evaluation of Existing Information Sources for Helicopter - Close-In Final Approach Segment (Continued)

5. Landing Line-up Markings and Lights - Landing line-up markings which are floodlit at night and landing lights including extended line-up and drop-line lights provide a poor source for lateral tracking error during the initial final approach but a moderate source as the helicopter closes on the ship during the close in portion. The marking and lights provide only task control information since the pilot does not receive, as desired, a specific visual indication when the task limit is reached. The pilot does, however, readily see if he is to one side or the other of the slot and does receive some indication of error rate of change as adjustments are made.

6. Glide Slope Indicator - Pilots indicated that they needed a task limit warning and error rate of change with regard to vertical approach slope tracking error. The glide slope indicator was evaluated as only providing task limit information since it fails to specifically indicate a warning such as a flashing light. In addition, the glide slope indicator was rated as only providing error direction information because error magnitude is not provided in a precise manner such as with a spectrum of red, green and amber light, to indicate when the aircraft is, for example, slightly below, moderately below, or extremely below the approach path. Some order of magnitude can be, however, perceived from the three sectors.

In terms of visual perception of the glide slope indicator, it is a strong source during the initial final approach at night with 7 mile visibility, but a weak source with 1 mile visibility. During the day VFR and day or night IFR condition, it cannot be seen. During the close in portion of the final approach the glide slope indicator is a strong source at night and a moderate source during the day under VFR conditions and can barely be perceived during IFR conditions.

E. DEFICIENCY

A summary of the most highly rated visual sources contained in Figures 2-6 and 2-7 are listed in Figures 2-8 and 2-9 excluding any form of electronic aids or visual signals.

1. Perception of Aids - Under IFR conditions, the existing aids are not visible during the initial final approach segment and only barely at the beginning of the close in portion. Therefore, the pilot must either rely on electronic aids or, in the case of EMCON, attempt to fly within visual range of the ship using the square search pattern.

Under VFR conditions of 7 miles visibility, the pilot can perceive the aids relatively well during the day or at night. Under VFR conditions with 1 mile visibility, however, the aids can only be perceived as a strong source as the pilot completes the initial final approach and commences the close in portion.

2. Range Milestone, Closure Rate Error and Ship Motion Information - is provided only by the view of the ship which is at best only satisfactory during the day and rated as a weak source at night. Without a good indication of distance from the ship, it is difficult to establish a range milestone, and thus adjust closure rate.

INFORMATION REQUIREMENT	Information Provided														
	LEVEL/TYPE					Condition									
						Day					Night				
						VFR		IFR			VFR		IFR		
	LATERAL	LONG./SPD.	VERTICAL	AZIMUTH	INSTRUCT.	7 mi	1 mi	1/2 mi	700 ft	300 ft	7 mi	1 mi	1/2 mi	700 ft	300 ft
Identity															
Inbound Heading															
Base Recovery Course															
Ship Course Ambiguity															
Pattern Orientation															
Pattern Dimensions															
Relative Wind Update **					1	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV
Signal Delta/Charlie															
Range															
Range Rate															
Time-to-turn Milestone															
Lateral Tracking Error	2B					1A	1A	NV	NV	NV	1A	1A	NV	NV	NV
Approach Slope Tracking Error			3B			NV	NV	NV	NV	NV	2A+	2A-	NV	NV	NV
Range Milestone					1	1	1	NV	NV	NV	1-	1-	NV	NV	NV
Obstacle Clearance															
Relative Altitude															
Longitudinal Hover Position															
Lateral Hover Position															
Hover Azimuth Error															
Deck Status *, **					1	1	1	NV	NV	NV	1+	1+	NV	NV	NV
Ship Motion **					1	1	1	NV	NV	NV	1-	1-	NV	NV	NV
Wave off					1	1	1	NV	NV	NV	1	1	N	NV	NV
Horizontal Reference															
Hover Height															
Closure Rate Error		1B				1A	1A	NV	NV	NV	1A=	1A=	NV	NV	NV
Aircraft Flight Instruments															

* LSE Rating not included
** Voice Rating not included

Not Visible - NV
Strong source - +
Moderate source - blank
Weak source - -
Very weak source - =

Figure 2-8. Summary of Information Required Versus Information Provided for Helicopters - Initial Final Approach Segment

INFORMATION REQUIREMENT	LEVEL/TYPE					Information Provided									
						Condition									
						Day					Night				
						VFR		IFR			VFR		IFR		
	LATERAL	LONG./SPD.	VERTICAL	AZIMUTH	INSTRUCT.	7 mi	1 mi	1/2 mi	700 ft	300 ft	7 mi	1 mi	1/2 mi	700 ft	300 ft
Identity															
Inbound Heading															
Base Recovery Course **					1										
Ship Course Ambiguity															
Pattern Orientation															
Pattern Dimensions															
Relative Wind **					1	1-	1-	1-	NV	NV	1-	1-	1-	NV	NV
Signal Delta/Charlie															
Range															
Range Rate															
Time-to-turn Milestone															
Lateral Tracking Error	2B					1C	1C	1C	NV	NV	1C	1C	1C	NV	NV
Approach Slope Tracking Error		3C				2A	2A	NV	NV	NV	2A+	2A+	2A-	NV	NV
Range Milestone					2	2-	2-	1-	NV	NV	1	1	1-	NV	NV
Obstacle Clearance															
Relative Altitude															
Longitudinal Hover Position															
Lateral Hover Position															
Hover Azimuth Error															
Deck Status *, **					1	1	1	NV	NV	NV	1	1	1-	NV	NV
Ship Motion					1	1+	1+	1-	NV	NV	1	1	1-	NV	NV
Wave off *, **					3	3+	3	3-	NV	NV	3+	3+	3	NV	NV
Horizontal Reference	1C	1C				1C+	1C	NV	NV	NV	1C-	1C=	NV	NV	NV
Hover Height															
Closure Rate Error		1B				1B	1B	1A	NV	NV	1A-	1A-	NV	NV	NV
Aircraft Flight Instruments															

* LSE Rating not included
** Voice Rating not included

Not Visible - NV
Strong source - +
Moderate source - blank
Weak source - -
Very weak source - =

Figure 2-9. Summary of Information Required Versus Information Provided for Helicopters - Close In Final Approach Segment

3. Line-up Markings and Lights - The line-up markings during the day and floodlit markings at night along with the line-up lights fail to provide a task limit warning, although as the pilot closes on the ship during the final $\frac{1}{2}$ mile, he is able to discern error rate of change.

4. Approach Slope Tracking Error - The glide slope indicator provides approach slope tracking information but fails to provide a precise indication of error magnitude or indication of error rate of change. In addition, the current intensity provides that it can only be seen during night VFR conditions while the pilot is commencing the final approach.

5. Deck Status and Wave-Off - Lights provide a good source for deck status and wave-off information, although neither can be seen in IFR conditions except during the final $\frac{1}{2}$ mile of the approach.

6. View of the Horizon - The view of the horizon depends on meteorological conditions. During times of high visibility the view of the horizon provides a strong source, whereas, during 7 miles visibility and less the horizon cannot be seen. The view of the ocean establishes, although, an artificial horizon at the extremities of the visibility. At night, however, the same effect may not be apparent due to the ceiling and light from the moon. It was generally concluded that during a day or night situation with $\frac{1}{2}$ mile visibility and less the view of the ocean would be minimal. The view of the ship was not included as a source since it moves and only provides horizontal information in relationship to the ocean.

7. Visual Signals - The pilots also indicated the need to be apprised of any changes in base recovery course and relative wind. No aids or procedures have been developed for accomplishing this task visually.

PART III. HOVER AND VERTICAL LANDING

A. SCENARIO

The hover segment begins once transition to hovering flight is undertaken, and includes translational flight to the point from which the VERTREP, HIFR, MK 105 SLED, RAST or vertical landing is commenced. During this segment, flight is conducted primarily by visual reference to the point of intended landing.

The vertical landing segment commences with the aircraft in hover over the touchdown point, and includes the vertical descent, touchdown and any recovery-assist and aircraft securing operations.

B. PILOT INFORMATION REQUIREMENTS

A review of the data contained in Figure 2-10 indicates the percentage of pilots which concurred with the information requirements and ratings suggested in the survey. In reviewing the percentages derived, it appears that there is substantial agreement with regard to the need for:

Information Requirements	Type	Navy at Sea						Marines at Sea			Marines at Sea & Shore
		H-2 (Note 1)	H-2/H-46 (Note 1A)	H-46 (Note 2)	H-46 (Note 3)	H-53 (Note 4)	H-53 (Note 5)	UH-1/AH-1 (Note 6)	H-46 (Note 7)	H-53 (Note 8)	H-1/H-46/H-53 (Note 9)
Relative Wind	Lateral - Speed Long'l - Vertical - Azimuth Safety Limit Warning - Error Magnitude	95%/95%	100%/100%	100%/100%	86%/100%	100%/	80%/ --	96%/100%	89%/89%	100%/100%	86%/90%
Lateral Tracking Error	Lateral - Task Limit Warning - Rate of Change	80%/ --	29%/67%	100%/ --	86%/ --	100%/ --	60%/ --	100%/ --	95%/ --	100%/ --	93%/ --
Obstacle Clearance	Lateral - Speed/Long'l - Vertical - Azimuth Safety Limit Warning - Error Magnitude	100%/100%	100%/100%	100%/100%	86%/100%	100%/100%	100%/--	100%/100%	100%/100%	100%/92%	71%/71%
Relative Altitude	Vertical - Safety Limit Warning - Rate of Change	70%/ --	29%/67%	78%/ --	100%/ --	100%/ --		100%/ --	100%/ --	100%/ --	71%/ --
Longitudinal Hover Position	Longitudinal - Task Limit Warning - Change in Error Rate of Change	50%/ --	29%/67%	100%/ --	86%/ --	100%/ --	60%/ --	100%/ --	95%/ --	82%/ --	82%/ --
	Longitudinal - Safety Limit Warning - Change in Error Rate of Change	25%/95%	43%/--	-- /100%	-- /67%	-- /100%	20%/ --	-- /100%	-- /100%	-- /100%	-- /95%
Lateral Hover Position	Lateral - Task Limit Warning - Change in Error Rate of Change	50%/ --	29%/67%	100%/ --	86%/ --	100%/ --	60%/ --	100%/ --	89%/ --	82%/ --	82%/ --
	Lateral - Safety Limit Warning - Change in Error Rate of Change	25%/95%	43%/--	-- /100%	-- /67%	-- /100%	20%/ --	-- /100%	-- /100%	-- /100%	-- /95%
Hover Azimuth Error	Azimuth - Task Control/Limit - Error Magnitude	85%/50%	29%/33%	67%/78%	71%/ --	100%/ --	100%/--	100%/89%	84%/67%	64%/67%	86%/67%
	Azimuth - Safety Limit Warning - Rate of Change and Change of				-- /100%	-- /100%					
Deck Status	Instructional - Task Control	55%/ --	-- /--	100%/ --	29%/ --	100%/ --		75%/ --	53%/ *	55%/ --	32%/ --
	Instructional - Task Limit Warning/ Safety Limit Warning				-- /22%					-- /8%	39%/ --
Ship Motion	Lateral - Speed/Long'l - Vertical Task Limit Warning - Rate of Change	100%/ --	71%/100%	100%/ --	100%/ --	100%/ --		* / --	100%/ --	91%/ --	89%/ --
	Lateral - Speed Long'l - Vertical Task Limit Warning - Change in Error Rate of Change	-- /70%		-- /89%	-- /67%	-- /100%	20%/ --	-- /100%	-- /83%	-- /92%	-- /86%
Wave Off	Instructional - Task/Safety Limit Warning	100%/100%	71%/33%	-- /67%	57%/22%	100%/ --	60%/ --	100%/ --	100%/16%	91%/25%	93%/14%
Horizontal Reference	Lateral - Speed/Long'l - Vertical Task Control - Error Magnitude	85%/85%	71%/100%	100%/100%	100%/78%	100%/100%	100%/ --	96%/96%	95%/94%	55%/75%	79%/90%
Hover Height	Vertical - Task Control - Rate of Change	85%/ --		100%/ --	43%/ --		60%/ --	96%/ --	58%/ --	64%/ --	71%/ --
	Vertical - Task Control/Limit - Change in Error Rate of Change	-- /55%	43%/33%	-- /100%	-- /100%	67%/34%	40%/ --	-- /93%	-- /67%	-- /92%	-- /86%
Closure Rate Error	Speed/Long'l - Task Limit Warning Error Magnitude	55%/ --	29%/66%	78%/ --	57%/ --		60%/ --	89%/ --	47%/ --	64%/ --	71%/ --
	Speed Long'l - Safety Limit Warning Change in Error Rate of Change					67%/34%					

* Data Unavailable

LEGEND:

Segment 5 700'	Segment 6 Vertical Landing

Except for Note 1A

Note 1 - H-2 Operating from Combatants, Sample Size 20 pilots Segments 5 and 6. (See Figure 6-1 series)
Note 1A - H-2/H-46 HIFR, Sample Size 4 and 3 pilots respectively, Segment 5 Only (See Figure 6-2/3 series)
Note 2 - H-46 Operating from Auxiliaries, Sample Size 9 pilots Segments 5 and 6. (See Figure 6-4 series)
Note 3 - H-46 Operating from Combatants, Sample Size 7 pilots Segment 5 and 9 pilots Segment 6. (See Figure 6-5 series)
Note 4 - H-53 Operating from LPD's, Sample Size 3 pilots Segments 5 and 6. (See Figure 6-6 series)
Note 5 - H-53 MK 105 Sled, Sample Size 5 pilots Segment 5 only. (See Figures 6-7/8/9 series)
Note 6 - UH-1/AH-1 Operating from LPH/LHA's, Sample Size 28 pilots Segments 5 and 6. (See Figure 10 series)
Note 7 - H-46 Operating from LPH/LHA's, Sample Size 19 pilots Segment 5 and 18 pilots Segment 6. (See Figure 11 series)
Note 8 - H-53 Operating from LPH/LHA's, Sample Size 11 pilots Segment 5 and 12 pilots Segment 6. (See Figure 12 series)
Note 9 - H-1/H-46/H-53 Operating from LPH/LHA's and Shore Bases, Sample Size 28 pilots Segment 5 and 21 pilots Segment 6. (See Figures 13/14/15/16 series)

Figure 2-10. Helicopter Pilot Concurrence with Information Requirements - Hover and Vertical Landing Segments

1. Relative wind
2. Deck status and wave-off
3. Ship motion
4. Obstacle clearance
5. Lateral tracking error, relative altitude and closure rate during the hover segment
6. Longitudinal, lateral and azimuth hover error and hover height during the hover and vertical landing
7. Horizontal reference

A significant point, with regard to the above information, is the tendency on the part of the pilots to require practically the same information for hover and vertical landing except for increased levels and types of data for the vertical landing. Where, for example, pilots indicated a need for task control information during the hover segment, they would indicate a need for task control warning or, even, safety limit warning for the vertical landing segment. The pilots also indicated a similar preference in requesting error magnitude information during the hover segment but error rate of change or, even, change in error rate of change during the vertical landing segment. Other observations are discussed below:

1. Hover Azimuth Error - was particularly important for helicopters with tandem rotors.

2. Deck Status - H-46 VERTREP pilots seemed to be particularly concerned about deck status.

3. Hover Position Error - requirements were particularly important for VERTREP, HIFR and MK-105 SLED operations.

C. EVALUATION CRITERIA

The pilot was considered totally visual during these segments. Problems associated with perceiving cues in various meteorological conditions are nearly non-existent at this range, although sources were generally rated lower at night due to the difficulties in perceiving contrasting and reference information.

D. EVALUATION OF EXISTING SOURCES

The ten basic sources of information for the hover and vertical landing segments are rated in Figures 2-11 and 2-12 and discussed below:

1. Electronic Aids - such as TACAN and radar were not rated during this final phase since these segments are essentially visual even under the worst meteorological conditions.

Voice communications were rated but not, however, during the EMCON condition. It should be emphasized that voice communications are a strong source for obtaining information relative to wind, deck status and wave-off.

REQUIREMENT							EVALUATION													
	LEVEL/TYPE						LEVEL/TYPE													
								VFR								IFR				
								NORMAL 7 MI. VIS.				SPECIAL 1 MI. VIS.				NORMAL ½ MI. VIS.		EMERGENCY 300 FT. VIS.		NAVTOLAND 700 FT. VIS.	
								DAY		NIGHT		DAY		NIGHT							
INFORMATION	LATERAL	LONG./SPD.	VERTICAL	AZIMUTH	INSTRUCT	SOURCE	EA	E	EA	E	EA	E	EA	E	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
Relative Wind	3B	3B	3B	3B		Voice Communications	3	NA	3	NA	3	NA	3	NA	3	3	3	3	3	3
						Wind Sock	1	1	1	1	1	1	1	1	1	1	NV	NV	1-	1-
Lateral Tracking Error	2C					Line-Up Lights	NA	NA	2C+	2C+	NA	NA	2C+	2C+	NA	2C+	NV	NV	?	2C+
						Line-Up Marking	2C+	2C+	2C	2C	2C+	2C+	2C	2C	2C	2C	NV	NV	2C	NV
						LSE	3A	3A	3A	3A	3A	3A	3A	3A	3A	3A	NV	NV	3A	3A-
Obstacle Clearance	3B	3B	3B	3B		LSE	3A+	3A+	3A+	3A+	3A+	3A+	3A+	3A+	3A+	3A+	NV	NV	3A-	3A-
						Hangar Forward Structure Floodlights	NA	NA	2C+	2C+	NA	NA	2C	2C	2C	2C	NV	NV	2C	2C
						View of Obstacles Aboard Ship	2C+	2C+	2C-	2C-	2C+	2C+	2C-	2C-	2C+	2C-	NV	NV	2C-	2C-
Relative Altitude			3C			View of Ship	2B+	2B+	2B	2B	2B+	2B+	2B	2B	2B+	2B	NV	NV	2B-	2B-
						LSE	3A+	3A+	3A+	3A+	3A+	3A+	3A+	3A+	3A+	3A+	NV	NV	3A-	3A-
Longitudinal Hover Position Error		2D				View of Ship	2C+	2C+	2C	2C	2C+	2C+	2C	2C	2C+	2C	NV	NV	2C+	2C
						LSE	3A+	3A+	3A+	3A+	3A+	3A+	3A+	3A+	3A+	3A+	NV	NV	3A-	3A-
Lateral Hover Position Error	2D					View of Ship	2C+	2C+	2C	2C	2C+	2C+	2C	2C	2C+	2C	NV	NV	2C+	2C
						LSE	3A+	3A+	3A	3A	3A+	3A+	3A	3A	3A+	3A	NV	NV	3A+	3A
Hover Azimuth Error				1B		View of Ship	2C+	2C+	2C	2C	2C+	2C+	2C	2C	2C+	2C	NV	NV	2C+	2C
						LSE	3A+	3A+	3A	3A	3A+	3A+	3A	3A	3A+	3A	NV	NV	3A+	3A

Not Applicable (NA); Not Visible (NV); Electronic Aids (EA); EMCON (E); strong source (+); weak source (-); very weak source (=); moderate source (blank)

Figure 2-11. Evaluation of Existing Information Sources for Helicopters - Hover Segment

REQUIREMENT						EVALUATION													
	LEVEL/TYPE						LEVEL/TYPE												
							VFR								IFR				
							NORMAL 7 MI. VIS.				SPECIAL 1 MI. VIS.				NORMAL ½ MI. VIS.		EMERGENCY 300 FT. VIS.		NAVTOLAND 700 FT. VIS.	
							DAY		NIGHT		DAY		NIGHT							
INFORMATION	LATERAL	LONG./SPD	VERTICAL	AZIMUTH	INSTRUCT.	SOURCE	EA	E	EA	E	EA	E	EA	E	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
Deck Status					1	Voice Communications	1+	NA	1+	NA	1+	NA	1+	NA	1+	1+	1+	1+	1+	1+
						Deck Status Light	1+	1+	1+	1+	1+	1+	1+	1+	1+	1+	NV	NV	1+	1+
						Flag Hoist	1	1	1	1	1	1	1	1	1	1	NV	NV	1	1
						LSE	1+	1+	1+	1+	1+	1+	1+	1+	1+	1+	NV	NV	1+	1+
Ship Motion	2C	2C	2C			View of Ship	1C+	1C+	2C	2C	2C+	2C+	2C	2C	2C+	2C	NV	NV	2C+	2C
Wave-Off					3	Wave-Off Light	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+	NV	NV	3+	3+
						Voice Communications	3+	NA	3+	NA	3+	NA	3+	NA	3+	3+	3+	3+	3+	3+
						LSE	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+	NV	NV	3+	3+
Horizontal Reference	1B	1B	1B			Horizon and Sense of Horizon	1C+	1C+	1C-	1C-	1C-	1C-	1C=	1C=	1C	1C=	NV	NV	1C-	1C=
Hover Height			1C			View of Ship	1C+	1C+	1C-	1C-	1C+	1C+	1C-	1C-	1C	1C-	NV	NV	1C	1C-
						LSE	1A+	1A+	1A+	1A+	1A+	1A+	1A+	1A+	1A+	1A+	NV	NV	1A+	1A+
Closure Rate Error		2B				View of Ship	1B	1B	1A-	1A-	1B	1B	1A-	1A-	1A	1A-	NV	NV	1A	1A-

Not Applicable (NA); Not Visible (NV); Electronic Aids (EA); EMCON (E); strong source (+); weak source (-); very weak source (=); moderate source (blank)

Figure 2-11. Evaluation of Existing Information Sources for Helicopters - Hover Segment (Continued)

REQUIREMENT						EVALUATION													
INFORMATION	LEVEL/TYPE					SOURCE	LEVEL/TYPE												
							VFR								IFR				
							NORMAL 7 MI. VIS.				SPECIAL 1 MI. VIS.				NORMAL ½ MI. VIS.		EMERGENCY 300 FT. VIS		RAVTOLAND 700 FT. VIS.	
							DAY		NIGHT		DAY		NIGHT							
	LATERAL	LONG./SPD.	VERTICAL	AZIMUTH	INSTRUCT.		EA	E	EA	E	EA	E	EA	E	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
Relative Wind	3B	3B	3B	3B		Voice Communications	1	1	1	1	1	1	1	1	1	1	1	1	1	1
						Wind Sock	1	1	1	1	1	1	1		1	1	1	1	1	1
Obstacle Clearance	3B	3B	3B	3B		LSE	3A	3A	3A	3A	3A	3A	3A	3A	3A	3A	3A	3A	3A	3A
						View of Obstacles Aboard Ship	2C	2C	2C	2C	2C	2C	2C	2C	2C	2C	2C	2C	2C	2C
						Fwd Structure Floodlights	2C	2C	2C	2C	2C	2C	2C	2C	2C	2C	2C	2C	2C	2C
Longitudinal Hover Position Error		3D				View of Ship	2C+	2C+	2C	2C	2C+	2C+	2C	2C	2C+	2C	2C+	2C	2C+	2C
						LSE	3A+	3A+	3A+	3A+	3A+	3A+	3A+	3A+	3A+	3A+	3A+	3A+	3A+	3A+
Lateral Hover Position	3D					View of Ship	2C+	2C+	2C	2C	2C+	2C+	2C	2C	2C+	2C	2C+	2C	2C+	2C
						LSE	3A+	3A+	3A+	3A+	3A+	3A+	3A+	3A+	3A+	3A+	3A+	3A+	3A+	3A+
Hover Azimuth Error				1B		View of Ship	2C+	2C+	2C	2C	2C+	2C+	2C	2C	2C+	2C	2C+	2C	2C+	2C
						LSE	1A+	1A+	1A+	1A+	1A+	1A+	1A+	1A+	1A+	1A+	1A+	1A+	1A+	1A+
Deck Status					1	Voice Communications	1+	NA	1+	NA	1+	NA	1+	NA	1+	1+	1+	1+	1+	1+
						Deck Status Light	1+	1+	1+	1+	1+	1+	1+	1+	1+	1+	1+	1+	1+	1+
						Flag Hoist	1	1	1	1	1	1	1	1	1	1	1	1	1	1
						LSE	1+	1+	1+	1+	1+	1+	1+	1+	1+	1+	1+	1+	1+	1+
Ship Motion	2D	2D	2D			View of Ship	2C+	2C+	2C	2C	2C+	2C+	2C	2C	2C+	2C	2C+	2C	2C+	2C
Horizontal Reference	1B	1B	1B			Horizon & Sense of Horizon	1C+	1C+	1C-	1C-	1C-	1C-	1C=	1C=	1C-	1C=	1C-	1C=	1C-	1C=

Not Applicable (NA); Not Visible (NV); Electronic Aids (EA); EMCON (E); strong source (+); weak source (-); very weak source (=); moderate source (blank)

Figure 2-12. Evaluation of Existing Information Sources for Helicopters - Vertical Landing Segment

REQUIREMENT							EVALUATION													
INFORMATION	LEVEL/TYPE						LEVEL/TYPE													
								VFR								IFR					
								NORMAL 7 MI VIS				SPECIAL 1 MI VIS				NORMAL ½ MI VIS		EMERGENCY 300 FT VIS		HAVTORAND 700 FT VIS	
								DAY		NIGHT		DAY		NIGHT		DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
	LATERAL	LONG./SPD.	VERTICAL	AZIMUTH	INSTRUCT.	SOURCE	EA	E	EA	E	EA	E	EA	E						
Hover Height			1D			View of Ship	1C+	1C+	1C-	1C-	1C+	1C+	1C-	1C-	1C	1C-	1C	1C-	1C	1C-
						LSE	1A+	1A+	1A+	1A+	1A+	1A+	1A+	1A+	1A+	1A+	1A+	1A+	1A+	1A+
Wave-Off					3	Wave-Off Light	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+
						Voice Communications	3+	NA	3+	NA	3+	NA	3+	NA	3+	3+	3+	3+	3+	3+
						LSE	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+

Not Applicable (NA); Not Visible (NV); Electronic Aids (EA); EMCON (E); strong source (+); weak source (-); very weak source (=); moderate source (blank)

Figure 2-12. Evaluation of Existing Information Sources for Helicopters - Vertical Landing Segment (Continued)

2. View of the Ship - The view of the ship including the surfaces and markings during the day and the line-up, perimeter lights and floodlit surfaces at night provides the pilot with information for judging relative altitude, hover height, longitudinal hover position error, lateral hover position error, hover azimuth error, closure rate and ship motion. The source can generally be thought of as strong during the day but considerably weaker at night. Under IFR conditions, the view of the ship is visible during both segments except during the beginning of the hover segment when the helicopter is 600' - 700' from the ship and the visibility is 300'.

Although the source itself is, as indicated, fairly strong from a visual standpoint, it generally only provides a task limit warning information since it does not provide the pilot with any type of specific warning when he is too high/low or to either side of the desired approach. In addition, it generally provides an indication of error rate of change as the pilot maneuvers but not change in error rate of change.

3. View of Obstructions - The view of obstacles provides a strong source during the day and a lesser source at night when the obstacles are floodlit with overhead lights. As the pilot completes the hover and commences the vertical landing, he is unable to see the obstacles which he has cleared and focuses on any obstacles in front of the helicopter, such as the hangar. The view of the obstacles appears to give the pilot an indication of task limit warning and even error rate of change, although pilots indicated that a safety limit warning was necessary.

4. View of the Hangar Forward Structure - was also only rated as a task limit warning since the pilot does not receive a specific safety limit warning if he should become dangerously close to the hangar. It should be noted that the hangar forward structure provides important depth perception to the pilot as a part of the view of the ship.

5. Line-up Markings and Lights - Although already discussed in those sources described under view of the ship, are also described here due to their importance. It should be noted that the cues received from these sources are adequate while approaching the ship but are not visible as the pilot hovers over the landing area except for the landing area except for the extended line-up lights and some of the perimeter lights.

6. Wave-Off Deck Status Lights - Both light systems provide a strong source of instruction information. They can be readily seen except during the beginning of the hover segment with 300' visibility providing an instantaneous safety limit warning.

7. Flag Hoist - The flag hoist is also a source of deck status information, though not as strong a source or as instantaneous as the deck status light. The flag is not, in many cases, within the visual scan of the pilot.

8. Horizon and Sense of Horizon - As discussed in the final approach segment, horizontal reference, such as a view of the ocean, is dependent on meteorological conditions. It should also be noted that pilots indicated that only error magnitude as opposed to error rate of change requested during the final approach was required. It is suspected that this differ-

ence in rating is somewhat erroneous in that the pilot would like an indication of error rate of change but has, during the hover and vertical landing segments, started to concentrate solely on the ship. The view of the horizon was rated as a strong source during day VFR but a lesser source during IFR.

9. Wind Sock - As indicated during the final approach segment, the wind sock is not a very accurate method of providing relative wind, particularly on a moving ship. It is difficult to observe small changes in the wind sock direction and extremely difficult, if not impossible, to sense wind speed.

10. Landing Signalman Enlisted - The LSE is a primary source of information during day and night operations for the hover and landing segments. He is capable of providing lateral tracking error, obstacle clearance, relative altitude, longitudinal hover position error, lateral hover position error, hover azimuth error, deck status, wave-off and hover height information, although quite often not the type of information required. The LSE can provide a task safety limit warning by indicating a wave-off if he thinks the pilot is too low/high, to the side, or close to an obstruction. In this sense, the LSE is an excellent source of data. The LSE is, however, limited to providing only error direction and, depending on the LSE, some sense of error magnitude by the movement of his hands.

E. DEFICIENCY

A summary of the most highly rated visual sources contained in Figures 2-11 and 2-12 are listed in Figure 2-13 for the hover segment and Figure 2-14 for the vertical landing segment. The summary excludes electronic aids which could not be used under EMCON and visual signals which are not heavily relied upon by some helicopter pilots.

1. Perception of Aids - Under IFR conditions, VLA's are visible during the hover segment commencing at 600' to 700' from the ship except for 300' visibility. In this situation, the pilot must continue to rely on electronic aids or, in the case of EMCON, attempt to fly within visual range of the ship using the square search pattern.

Under VFR conditions of 7 mile or 1 mile visibility, the pilot perceives strong cues during the day and moderate cues at night.

2. Relative Wind - Aside from voice communication, the only indication of relative wind comes from the wind sock which is not visible during the commencement of the hover segment under 300' visibility or, at best, a poor source under even favorable conditions. Furthermore, there is no reasonable visual indication of wind measurement even if ship meteorological equipment is employed. Wind measurement equipment is usually installed on the superstructure which does not provide, according to NWP-42, a reliable source of data for the condition which is occurring on the flight deck. It is also questionable as to how a real time readout would help the pilot since he is likely to feel the effect at the controls as quickly or even more quickly than the equipment could measure a sudden gust of wind.

INFORMATION REQUIREMENT	LEVEL/TYPE					Information Provided: Condition									
						Day					Night				
						VFR		IFR			VFR		IFR		
	LATERAL	LONG./SPD.	VERTICAL	AZIMUTH	INSTRUCT.	7 mi	1 mi	1/2 mi	700 ft	300 ft	7 mi	1 mi	1/2 mi	700 ft	300 ft
Identity															
Inbound Heading															
Base Recovery Course															
Ship Course Ambiguity															
Pattern Orientation															
Pattern Dimensions															
Relative Wind **	3B	3B	$\overline{3}$B	3B		1	1	1	1-	NV	1	1	1	1-	NV
Signal Delta/Charlie															
Range															
Range Rate															
Time-to-turn Milestone															
Lateral Tracking Error *	2C					2C+	2C+	2C	2C	NV	2C	2C	2C	NV	NV
Approach Slope Tracking Error															
Range Milestone															
Obstacle Clearance *	$\overline{3}$B	$\overline{3}$B	$\overline{3}$B	$\overline{3}$B		2C+	2C+	2C+	2C-	NV	2C-	2C-	2C-	2C-	NV
Relative Altitude *			3C			2B+	2B+	2B+	2B-	NV	2B	2B	2B	2B-	NV
Longitudinal Hover Position *		2D				2C+	2C+	2C+	2C+	NV	2C	2C	2C	2C	NV
Lateral Hover Position *	2D					2C+	2C+	2C+	2C+	NV	2C	2C	2C	2C	NV
Hover Azimuth Error *				1B		2C+	2C+	2C+	2C+	NV	2C	2C	2C	2C	NV
Deck Status *					1	1+	1+	1+	1+	NV	1+	1+	1+	1+	NV
Ship Motion *, **	2C	2C	2C			2C+	2C+	2C+	2C+	NV	2C	2C	2C	2C	NV
Wave off *, **					3	3+	3+	3+	3+	NV	3+	3+	3+	3+	NV
Horizontal Reference	1B	1B	1B			1C+	1C-	1C-	1C-	NV	1C-	1C=	1C=	1C=	NV
Hover Height *			1C			1C+	1C+	1C	1C	NV	1C-	1C-	1C-	1C-	NV
Closure Rate Error		2B				1B	1B	1A	1A	NV	1A-	1A-	1A-	1A-	NV
Aircraft Flight Instruments															

* LSE Rating not included
** Voice Rating not included

Not Visible - NV
Strong source - +
Moderate source - blank
Weak source - -
Very weak source - =

Figure 2-13. Summary of Information Required Versus Information Provided for Helicopters - Hover Segment

INFORMATION REQUIREMENT	LEVEL/TYPE					Information Provided									
						Condition									
						Day					Night				
						VFR		IFR			VFR		IFR		
	LATERAL	LONG./SPD.	VERTICAL	AZIMUTH	INSTRUCT.	7 mi	1 mi	1/2 mi	700 ft	300 ft	7 mi	1 mi	1/2 mi	700 ft	300 ft
Identity															
Inbound Heading															
Base Recovery Course															
Ship Course Ambiguity															
Pattern Orientation															
Pattern Dimensions															
Relative Wind **	3B	3B	3B	3B		1	1	1	1	1	1	1	1	1	1
Signal Delta/Charlie															
Range															
Range Rate															
Time-to-turn Milestone															
Lateral Tracking Error															
Approach Slope Tracking Error															
Range Milestone															
Obstacle Clearance *	$\overline{3}$B	$\overline{3}$B	$\overline{3}$B	$\overline{3}$B		2C	2C	2C	2C	2C	2C	2C	2C	2C	2C
Relative Altitude															
Longitudinal Hover Position *		3D				2C+	2C+	2C+	2C+	2C+	2C	2C	2C	2C	2C
Lateral Hover Position *	3D					2C+	2C+	2C+	2C+	2C+	2C	2C	2C	2C	2C
Hover Azimuth Error *				1B		2C+	2C+	2C+	2C+	2C+	2C	2C	2C	2C	2C
Deck Status **					1	1+	1+	1+	1+	1+	1+	1+	1+	1+	1+
Ship Motion	2D	2D	2D			2C+	2C+	2C+	2C+	2C+	2C	2C	2C	2C	2C
Wave off *, **					3	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+
Horizontal Reference	1B	1B	1B			1C+	1C-	1C-	1C-	1C-	1C-	1C=	1C=	1C=	1C=
Hover Height *	1D					1C+	1C+	1C	1C	1C	1C-	1C-	1C-	1C-	1C-
Closure Rate Error															
Aircraft Flight Instruments															

* LSE Rating not included
** Voice Rating not included

Not Visible - NV
Strong source - +
Moderate source - blank
Weak source - -
Very weak source - =

Figure 2-14. Summary of Information Required Versus Information Provided for Helicopters - Vertical Landing Segment

3. Lateral Tracking Error, Relative Altitude and Closure Rate - Line-up markings and lights including extended line-up lights and drop-line lights provide a satisfactory source of lateral tracking error, except for providing a specific type of warning if the pilot strays too far to port or starboard of the desired path. As the pilot comes into a hover over the landing area, however, he loses site of most of the line-up display.

The view of the ship fails to provide the level of information desired by pilots with regard to both relative altitude and closure rate. The view of the ship is even less satisfactory at night.

4. Longitudinal Hover Position, Lateral Tracking Position, Hover Azimuth Error, and Hover Height - The line-up markings and lights including the extended line-up and drop-line lights provide satisfactory hover azimuth error. However, the markings and lights only provide a sense of error rate of change as opposed to the change in error rate of change desired for lateral and longitudinal hover position. Consequently, the pilot must watch to see the error, wait to see the amount of change and watch to see the extent of change in rate of change. As a result of this situation, it appears that a more instantaneous method is required. With regard to hover height, it appears that the level of information desired increases as the pilot moves into the vertical landing segment, although the existing sources only provide a degree of error rate of change.

5. Obstacle Clearance - The view of obstacles themselves provides at best a task limit warning but not the desired safety limit warning. No device currently warns the pilot of an impending collision with an obstruction. It is assumed that as a part of the marking criteria that if the pilot hovers correctly he will not contact any obstacles. Following that same logic, if more cues were provided with regard to following the ideal flight path and realizing errors, the less likelihood of contacting obstructions.

6. Deck Status and Wave-off - It appears that the deck status light and wave-off lights more than adequately provide the necessary instructional data to the pilot provided they are installed in a location where they can be readily observed.

7. Ship Motion and Horizontal Reference - The view of the ship both during the day and at night provide a satisfactory source of ship motion information until the vertical landing segment when the pilot attempts to sense the actual motions and nulls. In this situation, the pilot desires change of rate of change information but only received rate of change information. Although the horizontal reference provided by the ocean is a strong source during the day, it becomes a weak source during the night and even a weaker source as meteorological conditions approach minimums. Additional horizontal reference information is, therefore, needed.

SECTION III - AV-8A ANALYSIS

Current AV-8A procedures identify four methods of take-off and landing - Vertical Take-off and Vertical Landing, Rolling Vertical Take-off and Rolling Vertical Landing, Short Take-off and Slow Landing, and Conventional Take-off and Conventional Landing. For the purpose of this study, only the more demanding vertical landing operations from forward sites and shipboard platforms are considered.

Typical landing patterns are shown for shorebased VFR (Figure 3-1), for shipboard VFR (Figure 3-2), and for shipboard night IFR (Figure 3-3). As with the analysis contained in the previous section on helicopters, this section is also divided into three parts. The first part addresses the homing, orientation and initial approach and involves visual aids which are visible at long-range. The second part deals with the final approach and requires visual aids which are visible at a moderate range of about 2 to 3 miles. The third part examines the hover and vertical landing and involves visual aids which provide the close-in cues. The analysis conducted in each part begins with a scenario of the operation, the pilot information requirements, evaluation criteria, evaluation of existing sources of information, and the identification of deficiencies.

It should be noted that, unlike the helicopter flight scenario, the AV-8 operation is heavily dependent on navigational aids and voice communications. Further, because of the degree of precision required, LSO techniques, visual aids and radar control are employed during shipboard operations to reduce pilot workload to a reasonable level.

PART I. HOMING, ORIENTATION AND INITIAL APPROACH

A. SCENARIO

The homing, orientation, and initial approach segments are generally defined as follows:

- The homing segment includes the progress to any point from which the pilot undertakes a course to overfly the forward site or ship, or reach the marshalling position. The marshalling position is a point in space established relative to the ship from approach procedures such as those using TACAN or radar services, are commenced. In the instance of IFR, the marshall point is established approximately 15 miles from the ship.

- The orientation segment includes the pass of the forward site or ship and the turn to the down wind leg or any holding or Delta patterns prescribed for control of the aircraft awaiting clearance for an approach. For tactical sites, it is recommended that a clearing/identification pass be made at approximately 250 knots, 1000 feet, into the wind, and off to one side of the site for ease in viewing the landing zone and surrounding area. The pilot is to look for visual cues such as openings in trees and try to become aware of all of the

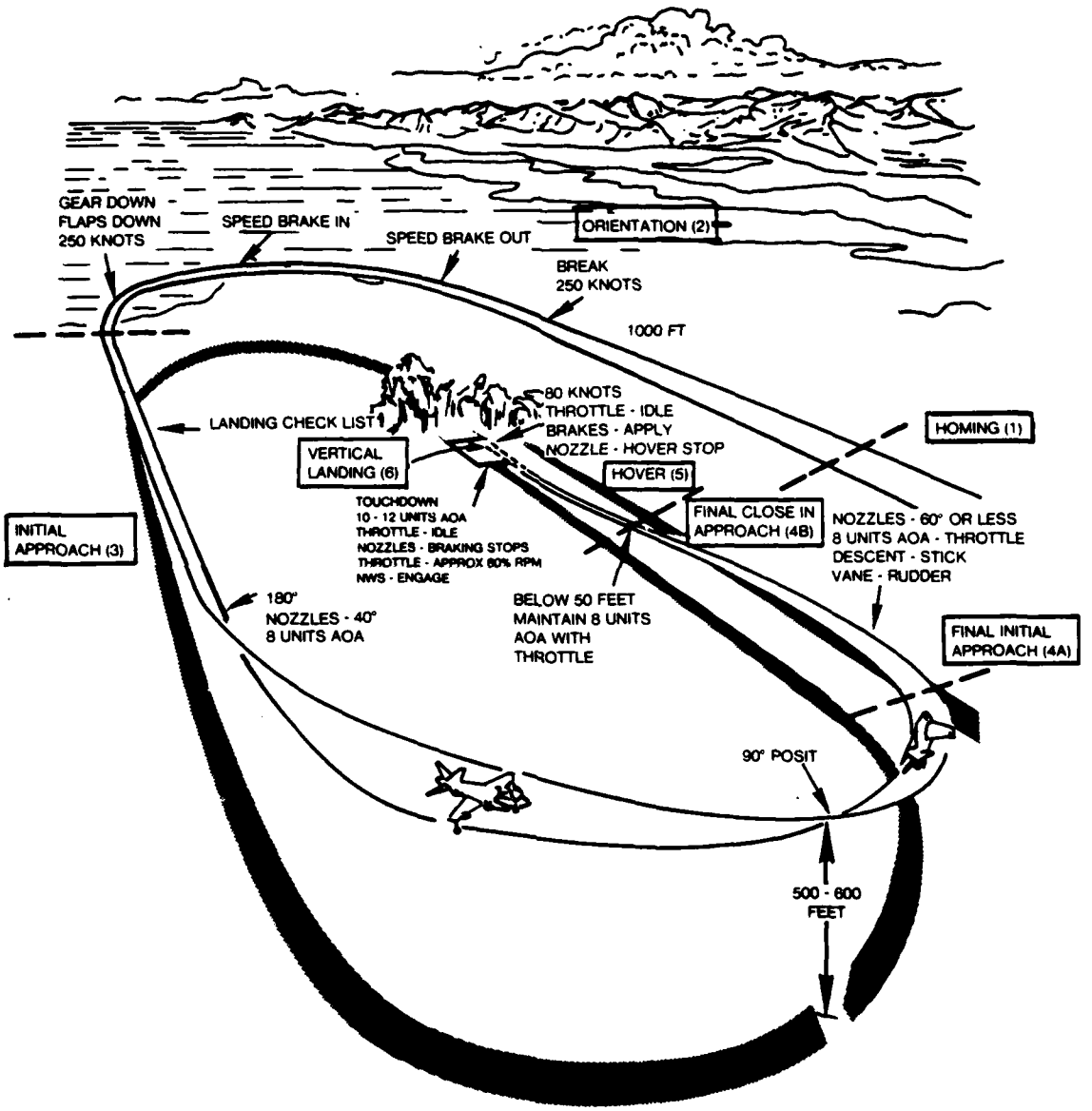

Figure 3-1. Typical Tactical Site VFR Landing Pattern for AV-8A

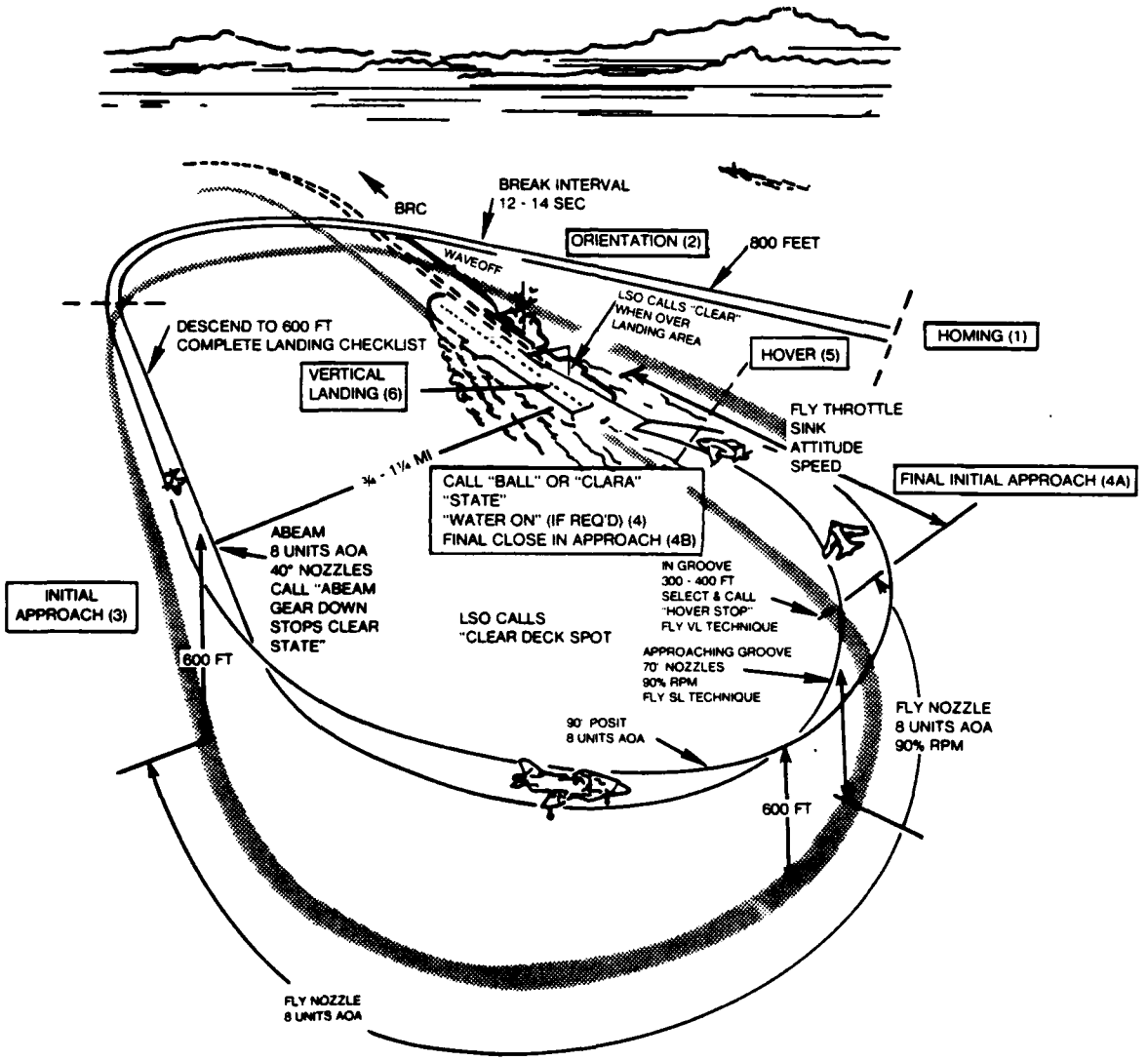

Figure 3-2. Typical Ship VFR Landing Pattern for AV-8A

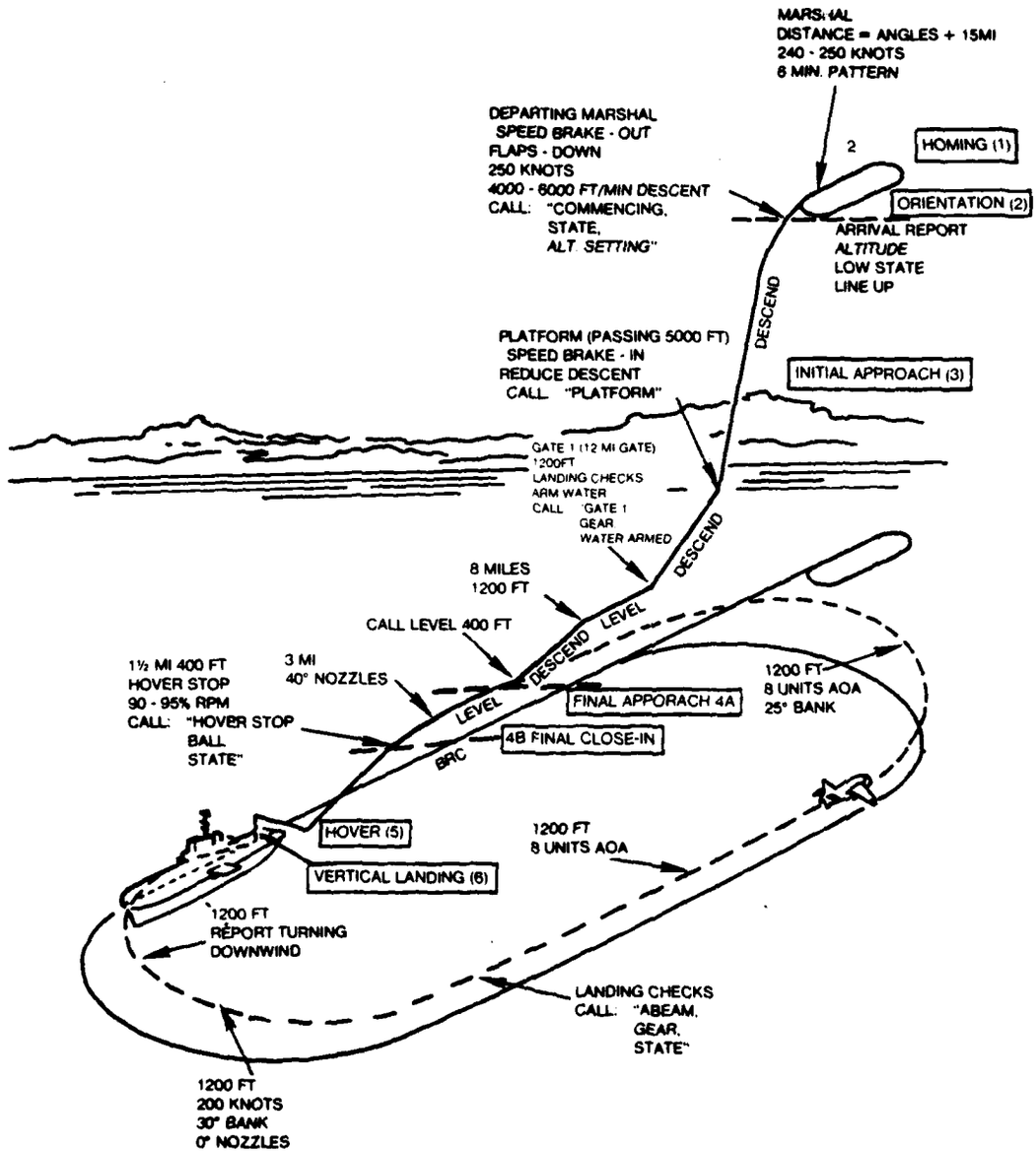

Figure 3-3. Typical Ship IFR Landing Pattern for AV-8A

predominant landmarks surrounding the zone. At approximately 5 to 10 seconds beyond the site, a turn crosswind is commenced in order to keep the zone in sight and adjust the angle of bank so as to arrive at a proper abeam position. The turn to the down wind leg is flown at a constant altitude of 1000 feet and at a constant airspeed to keep pilot workload down. For the ship, it is recommended that the pass under VFR be made at approximately 800 feet altitude with a break interval at 12 - 14 seconds. During night IFR, a 6 minute pattern is flown at 240 to 250 knots.

- The initial approach segment for VFR includes the down wind leg, and final turn and terminates upon completion of adjustments to the direction of flight, altitude and air speed necessary for established final approach conditions. The down wind leg of the pattern for tactical sites is flown at 1000 feet and is used to complete the landing checklist and re-acquire visual contact with the landing area and pre-selected visual cues. The down wind leg of the pattern for ship VFR conditions involves flying abeam 3/4 to 1 $\frac{1}{4}$ miles, completing the landing checklist and descending to 600 feet. The initial approach segment for IFR begins upon departure from the marshalling position at 4000 to 6000 feet per minute descent while maintaining 250 knots. The descent rate is reduced further at platform (5000 feet) until level off at 800 feet and 12 miles. Following departure from platform, the descent rate is progressively reduced so as not to exceed passing altitude in feet per minute. The initial approach is terminated as descent to 400 feet is completed and the aircraft is leveled.

B. PILOT INFORMATION REQUIREMENTS

The data contained in Figure 3-4 for the homing orientation and initial approach segment indicates the percentage of AV-8A Marine pilots which concur with the information requirements suggested in the survey. In reviewing the percentages, it appears that there is substantial agreement among the pilots with regard to the need of:

1. Identity and inbound heading information to locate the ship/tactical site.

2. Ships course ambiguity, base course recovery, pattern orientation, pattern dimensions, and signal Delta/Charlie information to determine the correct orientation to the ship/tactical site.

3. Range and range rate information to determine the point at which to start the initial approach.

4. Deck/tactical site status, relative wind, ship motion and density altitude information to determine the situation at the landing site.

A few noteworthy remarks follow:

1. Information for identity, inbound heading, and ships course ambiguity information is not required during the orientation and initial approach segments since it had already been established during the homing segment.

Information Requirements	Type	AV-8A	
		Sea (Note 1)	Shore (Note 2)
Identify	Instructional - Safety Limit Warning	80%	80%
Inbound Heading	Lateral - Task Control	100%	80%*
Base Recovery Course	Instructional - Task Control	80%*	80%
Ships Course Ambiguity	Instructional - Task Control	100%	100%*,**
Pattern Orientation/Dimensions	Instructional - Task Control	80%*	80%*
Relative Wind	Instructional - Task Control	100%*	80%*
Signal Delta/Charlie	Instructional - Task Limit Warning	100%*	100%*
Range	Instructional - Task Control	100%	100%
Range Rate	Instructional - Task Control	100%	100%
Deck/Tactical Site Status	Instructional - Task Control	100%*	100%*,**
Time-to-turn Milestone	Instructional - Task Control	100%*	100%*
Density Altitude	Instructional - Task Limit Warning	80%*	60%*

Note 1 - AV-8A Marines to LPH/LHA - Sample Size 5 pilots (See Figure 6-17 series)

Note 2 - AV-8A Marines to Shore - Sample Size 5 pilots (See Figure 6-18 series)

* Percentage of agreement varied for segments 1, 2 and 3 - Maximum agreement indicated

** Pilots indicate shipboard requirement although data requested was for landbased only

Figure 3-4. AV-8A Pilot Concurrence with Information Requirements - Homing, Orientation and Initial Approach Segments

2. Pilots operating to tactical sites desired information such as obstacle clearance and relative altitude because of their particular concern of contacting obstructions.

3. The requirement for density altitude was added to the survey forms by a majority of the AV-8A pilots.

C. EVALUATION CRITERIA

In order to evaluate potential sources for homing, orientation and initial approach, some criteria had to be established with regard to the distance and altitude of the aircraft from the ship.

Unlike the helicopter evaluation criteria developed in Section II, AV-8A operational procedures are based on the use of electronic aids such as TACAN, voice communications and radar approach during IFR conditions. Therefore, all visual sources were considered not applicable during these segments because the pilot would not have visually acquired either the ship or tactical site.

D. EVALUATION OF EXISTING SOURCES

The five basic sources of information evaluated in Figure 3-5 for the homing, orientation and initial approach segments are discussed below:

1. Electronic Aids - including TACAN, radar and voice communications are strong sources of information for both identifying the ship/field and determining inbound heading, base course recovery and ships course/field position.

2. Homing Beacon - The existing homing beacon with 1,500 candelas provides a strong source at night assuming a visibility of 7 miles and, with electronics aids used to close within 1 mile of the ship, a strong source with only 1 mile visibility. The homing beacon is not, however, visible during all other conditions. During the day, with 7 mile visibility, for example, the homing beacon cannot be seen even when the aircraft is within 1 mile of the ship. This situation is further complicated as the visibility minimums are reduced. The homing beacon was rated not applicable during IFR conditions with electronic aids because the pilot is flying instruments and not using any external visual sources.

3. View of Ship - The view of the ship provides a strong source during the day with good visibility. At night, the view of the ships navigational lights or tactical site lights was rated as a strong to moderate source of identity information. During IFR conditions, the view of the ship or tactical site was considered not applicable because the pilot is on instruments.

4. Ships Wake - Provides a strong source for identifying the ship during the day under 7 mile visibility and a moderate source during the day under 1 mile visibility.

REQUIREMENT							EVALUATION							
	LEVEL/TYPE						LEVEL/TYPE							
							SHIPBOARD				SHOREBASED			
							VFR		IFR		VFR		IFR	
INFORMATION	LATERAL	LONG./SPD	VERTICAL	AZIMUTH	INSTRUCT.	SOURCE	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
Identify					3	Homing Beacon/	NV	1+	NA	NA	NV	1+	NA	NA
						View of Ship/Field	1+	1	NA	NA	1+	1	NA	NA
						Ships Wake	1+	NV	NA	NA	NA	NA	NA	NA
						Electronic Aids	3+	3+	3+	3+	3+	3+	3+	3+
Inbound Heading	1					Homing Beacon	NV	1+	NA	NA	NV	1+	NA	NA
						View of Ship/Field	1+	1	NA	NA	1+	1	NA	NA
						Ships Wake	1+	NV	NA	NA	NA	NA	NA	NA
						Electronic Aids	1+	1+	1+	1+	1+	1+	1+	1+
Remaining VFR ratings are based on the pilot having found the ship														
Base Recovery Course					1	View of Ship/Field	1+	1	NA	NA	1+	1	NA	NA
						Ships Wake	1+	NV	NA	NA	1+	1	NA	NA
						Electronic Aids	1+	1+	1+	1+	1+	1+	1+	1+
Ships Course/Field Ambiguity					1	View of Ship/Field	1+	1	NA	NA	1+	1	NA	NA
						Ships Wake	1+	NV	NA	NA	NA	NA	NA	NA
						Electronic Aids	1+	1+	1+	1+	1+	1+	1+	1+
Pattern Orientation					1	Electronic Aids	1+	1+	1+	1+	1+	1+	1+	1+
Pattern Dimensions					1	Electronic Aids	1+	1+	1+	1+	1+	1+	1+	1+
Relative Wind					1	Electronic Aids	1+	1+	1+	1+	1+	1+	1+	1+

Not Applicable (NA); Not Visible (NV); strong source (+); weak source (-); very weak source (=); moderate source (blank)

Figure 3-5. Evaluation of Existing Information Sources for AV-8A - Homing, Orientation and Initial Approach Segments

REQUIREMENT								EVALUATION							
INFORMATION	LEVEL/TYPE						SOURCE	LEVEL/TYPE							
								SHIPBOARD				SHOREBASED			
								VFR		IFR		VFR		IFR	
	LATERAL	LONG./SPD.	VERTICAL	AZIMUTH	INSTRUCT.			DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
Signal Delta/Charlie						2	Electronic Aids	2+	2+	2+	2+	2+	2+	2+	2+
							Visual Signal	2-	2	NA	NA			NA	NA
Range						1	Electronic Aids	1+	1+	1+	1+	1+	1+	1+	1+
							View of Ship/Field	1	1-	NA	NA	1	1-	NA	NA
							Ships Wake	1	NV	NA	NA	1	NV	NA	NA
Range Rate						1	Electronic Aids	1+	1+	1+	1+	1+	1+	1+	1+
							View of Ship/Field	1	1-	NA	NA	1	1-	NA	NA
Deck/Field Status						1	Electronic Aids	1+	1+	1+	1+	1+	1+	1+	1+
							Visual Signals			NA	NA			NA	NA
Time-to-Turn Milestone						1	Electronic Aids	1+	1+	1+	1+	1+	1+	1+	1+
							View of Ship/Field	1+	1	NA	NA	1+	1	NA	NA
Density Altitude						2	Electronic Aids	2+	2+	2+	2+	2+	2+	2+	2+

Not Applicable (NA); Not Visible (NV); strong source (+); weak source (-); very weak source (=); moderate source (blank)

Figure 3-5. Evaluation of Existing Information Sources for AV-8A - Homing, Orientation and Initial Approach Segments (continued)

5. Visual Signals - provide a strong source at night and a moderate source during the day in the case of EMCON or lost communications. The signals are described in NWP-63-1 and include; BINGO, add power, CHARLIE, DELTA, closed ship, do not land, lower wheels, lower flaps, jettison disposable fuel tank and jettison ordnance.

Another source of information, although not a visual source, is the pre-flight briefing and the standard procedures already contained in NWP-63-1 regarding standard patterns orientation, pattern dimensions, and time to turn milestones.

E. DEFICIENCY

A summary of the most highly rated visual sources contained in Figure 3-5 are listed in Figure 3-6, excluding any form of electronic aid or visual signals. Based on an analysis of the data, the following conclusions are drawn.

1. Under IFR conditions, the pilot can accomplish the homing, orientation and initial approach segments only with the use of electronic aids. Should the aids not be available, or if the ship is operating under EMCON conditions, the pilot can be, for the purposes of this study, considered under VFR conditions. In this situation, the pilot must navigate by dead reckoning to the best position and then fix appropriate triangles.

2. Except for VFR conditions with the visibility above 3 miles, the pilot is unable to acquire the ship and determine inbound heading.

3. The pilot may, after acquiring a ship, experience difficulty in differentiating the ships from other ships in the operating area.

4. Current signals do not allow for visual communication of data on base course recovery, ship course ambiguity, pattern orientation, pattern dimensions, relative wind, range, range rate.

PART II. FINAL APPROACH

A. SCENARIO

The final approach involves, for purpose of this study, pilot-controlled adjustments to flight direction, altitude and air speed which are necessary to maintain the desired flight path and speed relative to ship or tactical site. The segment terminates once the transition to hovering flight is undertaken. The final approach segment is, therefore, the leg within which landing site facilities become the primary source of visual information for task control. There is a continuity of pilot tasks throughout this segment. Although it is treated as an entity, the transition from primarily flight-instrument-means to visual site reference warranted a subdivision of the segment. For this reason, the final approach segment is considered in two parts: Segment 4A -- the initial portion of the final approach for VFR commences as the aircraft is in the groove at approximately $1\frac{1}{2}$ miles from the landing area at an altitude of 300 to 400 feet. The initial approach segment for IFR conditions assumes

Information Required	Information Provided													
	LEVEL/TYPE					Condition								
						Day				Night				
						Shipboard		Shorebased		Shipboard		Shorebased		
	LATERAL	LONG./SPD.	VERTICAL	AZIMUTH	INSTRUCT.	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR	
Identity*					3	1+	--	1+	--	1+	--	1+	--	
Inbound Heading*	1					1+	--	1+	--	1+	--	1+	--	
Base Recovery Course*					1	1+	--	1+	--	1	--	1	--	
Ship Course Ambiguity*					1	1+	--	1+	--	1	--	1	--	
Pattern Orientation*					1		--		--		--		--	
Pattern Dimensions*					1		--		--		--		--	
Relative Wind*					1		--		--		--		--	
Signal Delta/Charlie*					2	2-	--		--	2	--		--	
Range*					1	1	--	1	--	1-	--	1-	--	
Range Rate*					1	1	--	1	--	1-	--	1-	--	
Time-to-turn Milestone*					1	1+	--	1+	--	1	--	1	--	
Lateral Tracking Error														
Approach Slope Tracking Error														
Range Milestone														
Obstacle Clearance														
Relative Altitude														
Longitudinal Hover Position														
Lateral Hover Position														
Hover Azimuth Error														
Deck Status														
Ship Motion														
Wave off														
Horizontal Reference														
Hover Height														
Closure Rate Error														
Aircraft Flight Instruments														
Density Altitude					2									

* Excludes use of Electronic Aids
** Visual signals are not currently used to provide this information

Not Visible - NV
Strong source - +
Moderate source - blank
Weak source - -
Very weak source - =

Figure 3-6. Summary of Information Required versus Information Provided for AV-8A - Homing, Orientation and Initial Approach Segments

the aircraft is 3 to 4 miles from touchdown at about 300 feet altitude. During Segment 4B - the close-in part of the final approach, the pilot is within approximately 1 mile of the site under VFR conditions and $1\frac{1}{2}$ miles of the site under IFR conditions. In either case, the pilot is focusing his attention on the site.

B. PILOT INFORMATION REQUIREMENTS

A review of the data contained in Figure 3-7 indicates the information required by the pilots surveyed for the initial and close-in portions of the final approach. In reviewing the percentages derived, it appears that there is substantial concurrence among all pilots in most of the information requirements. Pilots generally agreed that the following information was needed:

1. Base recovery course, inbound heading and relative wind, range milestone instructional data for task control and, in some cases, task limit warning.

2. Relative altitude and obstruction clearance for task limit warning and safety limit warning.

3. Vertical approach slope tracking error for determining rate of change and safety limit warning; and lateral tracking error for determining error magnitude and task limit warning.

4. Closure rate error for determining task control error magnitude.

5. Horizontal reference cues for determining lateral and longitudinal task control error rate of change data.

6. Wave-off cues for determining instructional safety limit warning and deck status cues for determining instructional task control.

In reviewing the data further, it should be noted that:

1. Relative Wind - The requirement for relative wind data is particularly critical in shipboard operations and is required again in this segment as an up-date to previously provided data.

2. Obstacle Clearance and Relative Altitude - This data was of more concern to pilots operating from tactical sites due to the concern of contacting obstructions.

3. Horizontal Reference - The requirement for horizontal reference cues was unanimously agreed by pilots but only in the close-in part of the final approach.

Information Requirements	Type	AV-8A Sea (Note 1)	AV-8A Shore (Note 2)
Inbound Heading	Instructional - Task Limit Warning	20%/--	
	Instructional - Task Control		20%/--
Base Recovery Course	Instructional - Task Limit Warning	60%/--	
	Instructional - Task Control	-- /80%	40%/100%
Relative Wind	Instructional - Task Control	100%/60%	40%/ --
	Lateral - Safety Limit Warning - Error Magnitude		/25%
	Longitudinal - Safety Limit Warning - Error Magnitude		/25%
Lateral Tracking Error	Lateral - Task Limit Warning - Error Magnitude	100%/80%	60%/ 75%
Approach Slope Tracking Error	Vertical - Safety Limit Warning - Error Magnitude	100%/--	100%/--
	Vertical - Safety Limit Warning - Error Rate of Change	-- /100%	-- /100%
Range Milestone	Instructional - Task Limit Warning	40%/80%	-- / 50%
	Instructional - Task Control		60%/--
Obstacle Clearance	Instructional - Safety Limit Warning	-- /20%	20%/25%
Relative Altitude	Instructional - Task Limit Warning	-- /20%	40%/--
	Instructional - Safety Limit Warning		-- /20%
Deck Status	Instructional - Task Control	60%/60%	40%/75%
Wave-off	Instructional - Task Control	80%/--	60%/--
	Instructional - Safety Limit Warning	-- /100%	-- /100%
Horizontal Reference	Lateral - Task Control - Error Rate of Change	-- /100%	-- /100%
	Longitudinal - Task Control - Error Rate of Change	-- /100%	-- /100%
Closure Rate Error	Longitudinal - Task Control - Error Magnitude	100%/60%	60%/50%

Note 1 - AV-8A Marines to LPH/LHA - Sample Size 5 pilots (See Figure 6-17 series)

Note 2 - AV-8A Marines to Shore - Sample Size 5 pilots for segment 4A and 4 pilots for segment 4B (See Figure 6-18 series)

Legend

Segment 4A / Segment 4B

Figure 3-7. AV-8A Pilot Concurrence with Information Requirements - Final Approach Segment

C. EVALUATION CRITERIA

The site scene (centerline lights, drop-line lights and overhead floodlights, perimeter/edge lights and marking for ships) were not rated individually because data was not collected in sufficient detail to evaluate the cues provided by individual aids except in a general sense.

The precision approach radar is recommended for shooting approaches in conditions not less than $\frac{1}{2}$ mile visibility and 200 foot ceiling (1 mile and 300 for the AV-8A). The non-precision approach radar is not recommended in ceilings less than 400 feet and $1\frac{1}{2}$ miles visibility. The TACAN, ASR and ADF were not rated in Figures 3-8 and 3-9 individually as providing any source of data during the close-in portion of the final approach. In addition, it should be noted that the precision approach radar does not in itself provide required closure rate information because closure rate has to be computed by measuring the current speed and distance the aircraft is from the ship and comparing that with the desired numbers.

D. EVALUATION OF EXISTING SOURCES

The 6 basic sources of information evaluated in the initial and close-in portions of the final approach are rated in Figures 3-8 and 3-9, respectively, and discussed below:

1. Electronic Aids - including TACAN, radar and voice communications are rated as a strong source in providing all required information.

2. Rotary Beacon Signal System and Wave-Off Lights - the existing rotary beacon signal system and GSI wave-off lights provide a moderate source of deck status and wave-off information at night during the initial final approach with VFR minimums. As the pilot closes to the ship and commences the close-in portion, the lights become a strong source for deck status and wave-off information.

During day VFR conditions, it is questionable as to whether or not the lights can be readily seen during the initial final approach, although they were rated as moderate to weak sources during close-in portion of the approach.

During IFR conditions, the lights are barely visible at night during the initial portion of the final approach, but were rated as strong source during the close-in portion of the approach.

3. Wind Cone - Movements in the wind cone installed at tactical sites are hardly visible during the initial final approach and only provide a weak source of data during close-in portion whether during the day or at night. Even when the wind cone is visible, it is difficult to judge the amount of air flow. In addition, it provides an unreliable source of wind direction except when the pilot can view the wind cone from above at a close distance.

4. View of the Ship/Field - The view of the ship flight deck/island and the field during the day and VLA lighting in relation to ship navigational lights at night, provide only marginal visual cues with regard to range milestone, lateral tracking error, approach

REQUIREMENT							EVALUATION							
	LEVEL/TYPE						LEVEL/TYPE							
							SHIPBOARD				SHOREBASED			
							VFR		IFR		VFR		IFR	
INFORMATION	LATERAL	LONG./SPD.	VERTICAL	AZIMUTH	INSTRUCT.	SOURCE	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
Relative Wind (Potential Up-date)					1	Voice Communications	1+	1+	1+	1+	1+	1+	1+	1+
Lateral Tracking Error	2B					Navigational Aids	1+	1+	1+	1+	1+	1+	1+	1+
						Centerline/DropLine Lights	1A-	1A	NA	NA	1A-	1A	NA	NA
						Centerline Marking	1A	NV	NA	NA	1A	NV	NA	NA
						View of Ship/Field	1A-	1A=	NA	NA	1A	1A-	NA	NA
Approach Slope Tracking Error			3B			View of Ship/Field	1A-	1A=	NA	NA	1A	1A-	NA	NA
						GSI	NV	2A+	NA	NA	NV	2A+	NA	NA
						Navigational Aids	1+	1+	1+	1+	1+	1+	1+	1+
Range Milestone					2	View of Ship/Field	1	1-	NA	NA	1+	1	NA	NA
Obstacle Clearance (Shore)					3	View of Obstacles	NA	NA	NA	NA	1-	NV	NA	NA
Deck Status					1	Rotary Beacon Signal System	1=	1	NA	NA	NA	NA	NA	NA
						Voice Communications	1+	1+	1+	1+	1+	1+	1+	1+
Wave-Off					1	Voice Communications	1+	1+	1+	1+	1+	1+	1+	1+
						Rotary Beacon Signal System	1=	1	NA	NA			NA	NA
						GSI Wave-Off	1=	1	NA	NA			NA	NA
Closure Rate Error		1B				Navigational Aids	NA	NA	1A	1A	NA	NA	1A	1A
						View of Ship/Field	1A	1A-	NA	NA	1A+	1A	NA	NA

Not Applicable (NA); Not Visible (NV); strong source (+); weak source (-); very weak source (=); moderate source (blank)

Figure 3-8. Evaluation of Existing Information Sources for AV-8A - Initial Final Approach Segment

REQUIREMENT							EVALUATION								
	LEVEL/TYPE							LEVEL/TYPE							
								SHIPBOARD				SHOREBASED			
								VFR		IFR		VFR		IFR	
INFORMATION	LATERAL	LONG./RPD	VERTICAL	AZIMUTH	INSTRUCT.		SOURCE	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
Base Recovery Course					1		Voice Communications	1+	1+	1+	1+	1+	1+	1+	1+
Relative Wind	3A	3A		3	3		Voice Communications	1+	1+	1+	1+	3A+	3A+	3A+	3A+
	Shorebased Only														
Lateral Tracking Error	2B						View of Ship/Field	1B-	1A-	1B=	1A=	1B	1A	B-	1A-
							PAR	NA	NA	2B+	2B+	NA	NA	2B+	2B+
							Center Line/Drop Line Lights	1C-	1C	1C-	1C	1C-	1C	1C-	1C
							Line-up Marking	1C	NA	1C	NA	1C	NA	1C	NA
							Line-up Marking Floodlighted	NA	1C-	NA	1C-	NA	1C-	NA	1C-
Approach Slope Tracking Error			3C				View of Ship/Field	1B-	1A-	1B=	1A=	1B	1A	B-	1A-
							PAR	NA	NA	2B+	2B+	NA	NA	2B+	2B+
							GSI	2A	2A+	2A	2A+	2A	2A+	2A	2A+
Range Milestone					2		View of Ship	1B-	1A-	1B=	1A=	1B	1A	1B-	1A-
							PAR	NA	NA	2+	2+	NA	NA	2+	2+
Obstacle Clearance					3		View of Obstacles	NA	NA	NA	NA	1	NV	1	NV
							Obstacles Lighted	NA	NA	NA	NA	NA	1	NA	1
Relative Altitude					2/3		View of Ship/Field	2+	2	2+	2	2+	2	2+	2
							PAR	NA	NA	2+	2+	NA	NA	2+	2+
Deck Status					1		Rotary Beacon Signal System	1	1+	1-	1+	NA	NA	NA	NA
							Voice Communications	1+	1+	1+	1+	1+	1+	1+	1+
							GSI Wave-Off	1	1+	1-	1+	NA	NA	NA	NA

Not Applicable (NA); Not Visible (NV); strong source (+); weak source (-); very weak source (=); moderate source (blank)

Figure 3-9. Evaluation of Existing Information Sources for AV-8A - Close-In Final Approach Segment

REQUIREMENT							EVALUATION							
	LEVEL/TYPE						LEVEL/TYPE							
							SHIPBOARD				SHOREBASED			
							VFR		IFR		VFR		IFR	
INFORMATION	LATERAL	LONG./SPD	VERTICAL	AZIMUTH	INSTRUCT.	SOURCE	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
Horizontal Reference	1C	1C				View of Ocean	1C+	1C-	1C	1C=	NA	NA	NA	NA
						View of Land	NA	NA	NA	NA	1C+	1C	1C	1C-
Closure Rate Error		1B				PAR	1A	1A	1A	1A	1A	1A	1A	1A
						View of Ship/Land	1B	1A-	1B	1A-	1B	1A-	1B	1A-
Wave-Off					3	Voice Communications	3	3	3	3	3	3	3	3
						GSI Wave-Off	3	3+	3-	3+	NA	NA	NA	NA
						Rotary Beacon Signal System	3	3+	3-	3+	NA	NA	NA	NA

Not Applicable (NA); Not Visible (NV); strong source (+); weak source (-); very weak source (=); moderate source (blank)

Figure 3-9. Evaluation of Existing Information Sources for AV-8A - Close-In Final Approach Segment (continued)

slope tracking error and closure rate error. The pilot can compare the size of the ship and vertical and lateral position of the ship with respect to the aircraft's window although these cues provide more of a sense of error direction rather than error magnitude. This information comparison is, however, influenced significantly by the side slip and yaw of the aircraft. The source is generally not as good at night as it is during the day because fewer cues are provided. In addition, neither ship or field can be seen during certain IFR conditions while commencing the initial portion of the final approach. The view of the ship, however, provides a strong source during the close-in portion for ship motion assuming that some horizontal reference, such as the view of the ocean, is also within the field of view.

5. Landing Centerline Markings and Lights - Landing centerline markings which are floodlit at night and centerline lights including extended line-up and drop-line lights provide a poor source for lateral tracking error during the initial final approach, but a moderate source as the aircraft closes on the ship during the close-in portion. The marking and lights provide only task control information since the pilot does not receive, as desired, a specific visual indication when the task limit is reached. The pilot does, however, readily see if he is to one side or the other of the slot and does receive some indication of error rate of change as adjustments are made.

6. Glide Slope Indicator - Pilots indicated that they needed a task limit warning and error rate of change with regard to vertical approach slope tracking error. The glide slope indicator was evaluated as only providing task limit information since it fails to specifically indicate a warning such as a flashing light while low. In addition, the glide slope indicator was rated as only providing error direction information because error magnitude is not provided in a precise manner such as with a spectrum of red, green and amber light, to indicate when the aircraft is, for example, slightly below, moderately below, or extremely below the approach path. Some order of magnitude can be, however, perceived from the three sectors. In terms of visual perception of the glide slope indicator, it is a strong source during the initial final approach at night under VFR conditions but can barely be seen during day VFR and day or night IFR condition. During the close-in portion, the glide slope indicator is a strong source at night and a moderate source during the day under VFR conditions.

E. DEFICIENCY

A summary of the most highly rated visual sources contained in Figures 3-8 and 3-9 are listed in Figures 3-10 and 3-11, excluding any form of electronic aids.

1. Perception of Aids - Under IFR conditions, the existing aids are not visible during the initial final approach and only barely at the beginning of the close-in portion. Therefore, the pilot must either rely on electronic aids or, in the case of EMCON, attempt to fly within visual range of the ship using the triangle search pattern.

Under VFR conditions of 5 mile visibility, the pilot can perceive the aids relatively well during the day or at night.

Information Required	Information Provided													
	LEVEL/TYPE					Condition								
						Day				Night				
						Shipboard		Shorebased		Shipboard		Shorebased		
	LATERAL	LONG./SPD.	VERTICAL	AZIMUTH	INSTRUCT.	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR	
Identity														
Inbound Heading														
Base Recovery Course														
Ship Course Ambiguity														
Pattern Orientation														
Pattern Dimensions														
Relative Wind (Up-date)*					1		--		--		--		--	
Signal Delta/Charlie														
Range														
Range Rate														
Time-to-turn Milestone														
Lateral Tracking Error *	2B					1A	--	1A	--	1A	--	1A	--	
Approach Slope Tracking Error*			3B			1A-	--	1A	--	2A+	--	2A+	--	
Range Milestone					2	1	--	1+	--	1-	--	1	--	
Obstacle Clearance					3	NA	NA	1-	--	NA	NA	NV	--	
Relative Altitude														
Longitudinal Hover Position														
Lateral Hover Position														
Hover Azimuth Error														
Deck Status *					1	1=	NA	NA	NA	1	NA	NA	NA	
Ship Motion														
Wave off*						1=	NA		NA	1	NA		NA	
Horizontal Reference														
Hover Height														
Closure Rate Error *		1B				1A	NA	1A+	NA	1A-	NA	1A	NA	
Aircraft Flight Instruments														

* Voice Communications/ Navigation Aids ratings not included

Not Visible - NV
Strong source - +
Moderate source - blank
Weak source - -
Very weak source - =

Figure 3-10. Summary of Information Required versus Information Provided for AV-8A - Initial Final Approach Segment

Information Required	Information Provided													
	LEVEL/TYPE					Condition								
						Day				Night				
						Shipboard		Shorebased		Shipboard		Shorebased		
	LATERAL	LONG./SPD.	VERTICAL	AZIMUTH	INSTRUCT.	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR	
Identity														
Inbound Heading														
Base Recovery Course*					1									
Ship Course Ambiguity														
Pattern Orientation														
Pattern Dimensions														
Relative Wind*		Ship/Shore/			1/3A									
Signal Delta/Charlie														
Range														
Range Rate														
Time-to-turn Milestone														
Lateral Tracking Error *	2B					1C	1C	1C	1C	1C	1C	1C	1C	
Approach Slope Tracking Error*			3C			2A	2A	2A	2A	2A+	2A+	2A+	2A+	
Range Milestone*					2	1B-	1B=	1B	1B-	1A-	1A=	1A	1A-	
Obstacle Clearance					3	NA	NA	1	1	NA	NA	1	1	
Relative Altitude*		Ship/Shore/			2/3	2+	2+	2+	2+	2	2	2	2	
Longitudinal Hover Position														
Lateral Hover Position														
Hover Azimuth Error														
Deck Status*					1	1	1-	NA	NA	1+	1+	NA	NA	
Ship Motion														
Wave off					3	3	3-			3+	3+			
Horizontal Reference	1C	1C				1C+	1C	1C+	1C	1C-	1C=	1C	1C-	
Hover Height														
Closure Rate Error		1B				1B	1B	1B	1B	1A-	1A-	1A-	1A-	
Aircraft Flight Instruments														

* Voice Communications/ Navigation Aids ratings not included

Not Visible - NV
Strong source - +
Moderate source - blank
Weak source - -
Very weak source - =

Figure 3-11. Summary of Information Required versus Information Provided for AV-8A - Close-In Final Approach

2. Range Milestone and Closure Rate Error Information - is provided only by the view of the ship which is at best only satisfactory during the day and rated as a weak source at night. Without a good indication of distance from the ship, it is difficult to establish a range milestone and thus adjust closure rate.

3. Lateral Tracking Error - The centerline markings during the day and floodlit markings at night along with the centerline lights fail to provide a task limit warning, although as the pilot closes on the ship, he is able to discern error rate of change.

4. Approach Slope Tracking Error and Relative Altitude - The glide slope indicator provides approach slope tracking information but fails to provide a precise indication of error magnitude or indication of error rate of change. In addition, the current intensity provides that it can only be seen during night VFR conditions while the pilot is commencing the final approach. The view of the ship/field during the close-in portion of the final approach provides moderate to strong relative altitude cues, although pilots operating to fields indicated that safety limit warning data is needed.

5. Deck Status and Wave-Off Information - is provided by two good sources, the rotary beacon signal system and GSI wave-off lights, although neither can be seen in IFR conditions except during the close-in portion of the final approach.

6. Horizon Reference Information - The view of the horizon depends on meteorological conditions. During times of high visibility the view of the horizon provides a strong source, whereas during 7 miles visibility and less the horizon cannot be seen. The view of the ocean establishes, although, an artificial horizon at the extremities of the visibility. At night, the same effect may not be apparent due to the ceiling and light from the moon. It was generally concluded that during a day or night situation with $\frac{1}{2}$ mile visibility and less, the view of the ocean would be minimal. The view of the ship was not included as a source since it moves and only provides horizontal information in relationship to the ocean.

7. Base Recovery Course and Relative Wind - The pilots also indicated the need to be apprised of any changes in base recovery course and relative wind. No aid or procedure has been developed for accomplishing this task visually.

PART III. HOVER AND VERTICAL LANDING

A. SCENARIO

The hover and vertical landing segments are defined as follows:

- The hover segment begins once transition to hovering flight is undertaken, and includes translational flight to the point from which the vertical landing is begun. During this segment, flight is conducted primarily by visual reference to the point of intended landing. The edge of the forward site is crossed at approximately 50 feet altitude or above, although 100 feet altitude is recommended if the pad is on loose surface to reduce the possibility of a dust cloud impairing the pilot's view. For shipboard operations, the pilot flies

to a position abeam, or slightly aft of abeam, the landing spot and translates across the deck edge at 25 feet above the deck and zero rate of descent. The pilot must continue to keep the nose of the aircraft into the wind and at night should not land with a heading of more than 30° left of ship's heading to avoid possible loss of visual cues.

- The vertical landing segment commences with the aircraft in hover over the touchdown point, and includes the vertical descent, touchdown and any recovery-assist and aircraft securing operations.

B. PILOT INFORMATION REQUIREMENTS

A review of the data contained in Figure 3-12 indicates the percentage of pilots which agreed with the information requirements and ratings suggested in the survey. In reviewing the percentages derived, it appears that there is substantial agreement with regard to the need for:

1. Relative wind
2. Deck status and wave-off for the hover segment only
3. Ship motion
4. Obstacle clearance
5. Lateral tracking error, relative altitude and closure rate during the hover segment
6. Longitudinal, lateral and azimuth hover error and hover height during the hover and vertical landing
7. Horizontal reference

A significant point, with regard to the above information, is the tendency on the part of the pilots to require practically the same information for hover and vertical landing except to a greater degree. Where, for example, pilots indicated a need for task control information during the hover segment, they would indicate a need for task control warning or, even, safety limit warning for the vertical landing segment. The pilots also indicated a similar preference in requesting error magnitude information during the hover segment but error rate of change or, even, change in error rate of change during the vertical landing segment.

Another observation should be noted regarding the need for deck status and wave-off information during only the hover segment. Pilots indicated that this type of data could not be used once the aircraft had been committed to descent.

C. EVALUATION CRITERIA

The pilot was considered totally visual during these segments and is largely dependent on either voice communications and the view of the ship, particularly, the island, or the view of the tactical site. In the case of the tactical site, it is difficult to generalize on the type of cues which might be available because of the differences in terrain.

Information Requirements	Type	AV-8A Sea (Note 1)	AV-8A Shore (Note 2)
Relative Wind	Lateral - Safety Limit Warning - Error Magnitude	100%/100%	100%/75%
	Longitudinal - Safety Limit Warning - Error Magnitude	100%/100%	100%/75%
	Vertical - Safety Limit Warning - Error Magnitude	100%/100%	100%/75%
	Azimuth - Safety Limit Warning - Error Magnitude	100%/100%	100%/75%
Lateral Tracking Error	Lateral - Task Limit Warning - Error Rate of Change	100%/ --	100%/--
Obstacle Clearance	Lateral - Safety Limit Warning - Task Limit Warning	100%/100%	100%/75%
	Longitudinal - Safety Limit Warning - Task Limit Warning	100%/100%	100%/75%
	Vertical - Safety Limit Warning - Task Limit Warning	100%/100%	100%/75%
	Azimuth - Safety Limit Warning - Task Limit Warning	-- /100%	-- /75%
Relative Altitude	Vertical - Task Limit Warning - Error Rate of Change	100%/ --	100%/--
Longitudinal Hover Position	Longitudinal - Task Limit Warning - Change in Error Rate of Change	100%/ --	100%/--
	Longitudinal - Safety Limit Warning - Change in Error Rate of Change	-- /100%	-- /75%
Lateral Hover Position	Lateral - Task Limit Warning - Change in Error Rate of Change	100%/--	100%/--
	Lateral - Safety Limit Warning - Change in Error Rate of Change	-- /100%	-- /75%
Hover Azimuth Error	Azimuth - Task Control - Error Magnitude	100%/100%	100%/75%
Deck Status	Instructional - Task Control	60%/ --	-- /--
Ship Motion	Lateral - Task Limit Warning - Error Rate of Change	100%/ --	75%/--
	Lateral - Safety Limit Warning - Change in Error Rate of Change	-- /100%	-- /75%
	Longitudinal - Task Limit Warning - Error Rate of Change	100%/ --	75%/--
	Longitudinal - Safety Limit Warning - Change in Error Rate of Change	-- /100%	-- /75%
	Vertical - Task Limit Warning - Error Rate of Change	100%/ --	75%/--
	Vertical - Safety Limit Warning - Change in Error Rate of Change	-- /100%	-- /75%
Wave-off	Instructional - Safety Limit Warning	100%/ --	100%/--
Horizontal Reference	Lateral - Task Control - Error Magnitude	100%/100%	100%/75%
	Longitudinal - Task Control - Error Magnitude	100%/100%	100%/75%
	Vertical - Task Control - Error Magnitude	100%/100%	100%/75%
Hover Height	Vertical - Task Control - Error Rate of Change	60%/ --	50%/--
	Vertical - Task Control - Change in Error Rate of Change	-- /75%	-- /75%
Closure Rate Error	Longitudinal - Task Limit Warning - Error Magnitude	60%/--	75%/--

Note 1 - AV-8A Marines to LPH/LHA - Sample Size 5 pilots (See Figure 6-17 series)

Note 2 - AV-8A Marines to Shore - Sample Size 4 pilots (See Figure 6-18 series)

Legend

Segment 5 Hover / Segment 6 Vertical Landing

Figure 3-12. AV-8A Pilot Concurrence with Information Requirements - Hover and Vertical Landing Segments

It should also be noted that the problems associated with perceiving the cues in various meteorological conditions are nearly non-existent at this range. The sources were evaluated lower at night, however, due to the difficulties in perceiving contrasting and reference information.

D. EVALUATION OF EXISTING SOURCES

The eight basic sources of information considered essential in the hover and vertical landing segments are rated in Figure 3-13 and 3-14 and are discussed below:

1. Electronic Aids - such as TACAN and radar were not rated during this final phase since these segments are essential visually even under the worst meteorological conditions.

2. View of the Ship/Field - The view of the ship/field including the surfaces and markings during the day and the perimeter/edge lights and floodlit surfaces at night provides the pilot with information for judging relative altitude, hover height, longitudinal hover position error, lateral hover position error, hover azimuth error, closure rate and, in the case of ships, platform motion. The source can generally be thought of as strong during the day but considerably weaker at night.

Although the source itself is, as indicated, fairly strong from a visual standpoint, it generally only provides a task limit warning information since it does not provide the pilot with any type of specific warning when he is too high or low or to either side of the desired approach. In addition, the view generally provides an indication of error rate of change as the pilot maneuvers but not change in error rate of change.

The view of the ship/field decreases as the pilot transitions into the vertical landing segment.

3. View of Obstructions - The view of obstacles provides a strong source during the day and a lesser source at night when the obstacles are floodlit with overhead lights. As the pilot completes the hover and commences the vertical landing he is unable to see the obstacles which he has cleared and focuses on any obstacles in front or on side of the aircraft, such as the island. The view of the obstacles appears to give the pilot an indication of task limit warning and even error rate of change, although pilots indicated that a safety limit warning was necessary.

4. Centerline Markings and Lights - It should be noted that the cues received from these sources are adequate while approaching the ship but are not visible as the pilot hovers over the landing area.

5. Rotary Beacon Signal System - provides a strong source of instructional information, although the pilot's attention is usually focusing on cues other than the rotary beacon.

6. Horizon and Sense of Horizon - As discussed in the final approach segment, horizontal reference such as a view of the ocean is dependent on meteorological conditions. It

REQUIREMENT							EVALUATION								
INFORMATION	LEVEL/TYPE						SOURCE	LEVEL/TYPE							
								SHIPBOARD				SHOREBASED			
								VFR		IFR		VFR		IFR	
	LATERAL	LONG./SPD	VERTICAL	AZIMUTH	INSTRUCT			DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
Relative Wind	3B	3B	3B	3B			Voice Communications	3	3	3	3	3	3	3	3
Lateral Tracking Error	2C						Center Line Marking or Lights	NA	NA	NA	NA	2C+	2C+	2C+	2C+
							View of Ship and Island/Field	1B	1B-	1B	1B-	1B+	1B	1B+	1B
							LSO	3A	3A	3A	3A	NA	NA	NA	NA
Obstacle Clearance	3B	3B	3B	3B			View of Obstacles	2C+	2C-	2C+	2C-	2C+	2C-	2C+	2C-
							LSO	3A+	3A+	3A+	3A+	NA	NA	NA	NA
Relative Altitude			3C				View of Ship and Island/Field	2B+	2B	2B+	2B	2B+	2B+	2B+	2B+
							LSO	3A+	3A+	3A+	3A+	NA	NA	NA	NA
Longitudinal Hover Position		2D					View of Ship and Island/Field	2C+	2C	2C+	2C	2C	2C	2C	2C
							LSO	3A+	3A+	3A+	3A+	NA	NA	NA	NA
Lateral Hover Position	2D						View of Ship and Island/Field	2C+	2C	2C+	2C	2C+	2C	2C+	2C
							LSO	3A+	3A+	3A+	3A+	NA	NA	NA	NA
Hover Azimuth Error				1B			View of Ship and Island/Field	2C+	2C	2C+	2C	2C+	2C	2C+	2C
							LSO	3A+	3A+	3A+	3A+	NA	NA	NA	NA
Deck Status						1	Voice Communications	1+	1+	1+	1+	1+	1+	1+	1+
							Rotary Beacon Signal System	1+	1+	1+	1+	NA	NA	NA	NA
Ship Motion	2C	2C	2C				View of Ship and Island	1C+	2C	1C+	2C	NA	NA	NA	NA
Horizontal Reference	1B	1B	1B				Horizon and Sense of Horizon	1C+	1C-	1C	1C=	1C+	1C	1C+	1C-

Not Applicable (NA); strong source (+); weak source (-); very weak source (=); moderate source (blank)

Figure 3-13. Evaluation of Existing Information Sources for AV-8A - Hover Segment

REQUIREMENT							EVALUATION								
INFORMATION	LEVEL/TYPE						SOURCE	LEVEL/TYPE							
								SHIPBOARD				SHOREBASED			
								VFR		IFR		VFR		IFR	
	LATERAL	LONG./SPD.	VERTICAL	AZIMUTH	INSTRUCT.			DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
Wave-Off						3	Voice Communications	3+	3+	3+	3+	3+	3+	3+	3+
							Rotary Beacon Signal System	3+	3+	3+	3+	NA	NA	NA	NA
Hover Height			1C				View of Ship and Island/Field	1C+	1C-	1C-	1C=	1C+	1C	1C	1C-
							LSO	1A	1A	1A	1A	NA	NA	NA	NA
Closure Rate Error		2B					View of Ship and Island/Field	1B	1A-	1B	1A-	1B	1A	1B	1A-

Not Applicable (NA); strong source (+); weak source (-); very weak source (=); moderate source (blank)

Figure 3-13. Evaluation of Existing Information Sources for AV-8A - Hover Segment (continued)

REQUIREMENT							EVALUATION							
INFORMATION	LEVEL/TYPE					SOURCE	LEVEL/TYPE							
							SHIPBOARD				SHOREBASED			
							VFR		IFR		VFR		IFR	
	LATERAL	LONG./SPD.	VERTICAL	AZIMUTH	INSTRUCT.		DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
Relative Wind	3B	3B	3B	3B		Voice Communications								
Obstacle Clearance	3B	3B	3B	3B		View of Obstacles	2C	2C	2C	2C	2C	2C	2C	2C
						Structure Floodlights								
Longitudinal Hover Position		3D				View of Ship and Island/Field	2C+	2C	2C+	2C	2C+	2C	2C+	2C
Lateral Hover Position	3D					View of Ship and Island/Field	2C+	2C	2C+	2C	2C+	2C	2C+	2C
Hover Azimuth Error				1B		View of Ship and Island/Field	2C+	2C	2C+	2C	2C+	2C	2C+	2C
Ship Motion	2D	2D	2D			View of Ship	2C+	2C	2C+	2C	NA	NA	NA	NA
Horizontal Reference	1B	1B	1B			Horizon & Sense of Horizon	1C+	1C-	1C-	1C=	1C+	1C	1C	1C-
Hover Height			1D			View of Ship and Island/Field	1C+	1C-	1C+	1C-	1C+	1C-	1C+	1C-

Not Applicable (NA); strong source (+); weak source (-); very weak source (=); moderate source (blank)

Figure 3-14. Evaluation of Existing Information Sources for AV-8A - Vertical Landing Segment

should also be noted that pilots indicated that only error magnitude as opposed to error rate of change requested during the final approach was required. It is suspected that this difference in rating is somewhat erroneous in that the pilot would like an indication of error rate of change but has, during the hover and vertical landing segments, started to concentrate solely on nearby objects. The view of the horizon was rated as a strong source during the day but a weak source at night, particularly under IFR conditions.

7. Wind Cone - As indicated during the final approach segment, the wind cone is not a very accurate method of providing relative wind. It is difficult to observe small changes in the wind cone direction and extremely difficult, if not impossible, to sense wind speed. Furthermore, the view of the wind cone will most likely be obstructed from within the cockpit.

8. Landing Signal Officer - The LSO is a primary source of information during day and night operations for the hover and landing segments. He is capable of providing lateral tracking error, obstacle clearance, relative altitude, longitudinal hover position error, lateral hover position error, hover azimuth error, deck status, wave-off and hover height information. The LSO can provide a task safety limit warning by indicating a wave-off if he thinks the pilot is too low or high, to the side, or close to an obstruction. In this sense, the LSO is an excellent source of data. The LSO is, however, limited to providing only error direction and, depending on the LSO, some sense of error magnitude.

E. DEFICIENCY

A summary of the most highly rated visual sources contained in Figure 3-13 and 3-14 are listed in Figure 3-15 and 3-16 for the hover and vertical land segments. The summary excludes electronic aids which could not be used under EMCON and LSO signals provided through voice communications as opposed to purely visual sources.

1. Perception of Aids - Under either VFR or IFR conditions, the VLA are visible during the hover segment. Although the aids are visible from the standpoint of meteorological conditions, they are often obstructed during the vertical landing segment due to cockpit field of view.

2. Relative Wind - Aside from voice communication, the only indication of relative wind comes from extraneous sources such as ocean swells or, in the case of tactical sites, tree movements. The sources are, therefore, poor under even favorable conditions. Furthermore, there is no reasonable visual indication of wind measurement even if ship or field meteorological equipment is employed. Wind measurement equipment is usually installed on the superstructure which does not always provide a reliable source of data for the condition which is occurring in the area of the aircraft. It is also questionable as to how a real time readout would help the pilot since he is likely to feel the effect at the controls about as quickly or even more quickly than the equipment could measure a sudden gust of wind.

3. Lateral Tracking Error, Relative Altitude and Closure Rate - The view of the ship/field provides a satisfactory source of lateral tracking error, except for providing a specific

Information Required	Information Provided													
	LEVEL/TYPE					Condition								
						Day				Night				
						Shipboard		Shorebased		Shipboard		Shorebased		
	LATERAL	LONG./SPD.	VERTICAL	AZIMUTH	INSTRUCT.	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR	
Identity														
Inbound Heading														
Base Recovery Course														
Ship Course Ambiguity														
Pattern Orientation														
Pattern Dimensions														
Relative Wind*	3B	3B	$\overline{3}$B	3B										
Signal Delta/Charlie														
Range														
Range Rate														
Time-to-turn Milestone														
Lateral Tracking Error	2C					1B	1B	2C+	2C+	1B-	1B-	2C+	2C+	
Approach Slope Tracking Error														
Range Milestone														
Obstacle Clearance	$\overline{3}$B	$\overline{3}$B	$\overline{3}$B			2C+	2C+	2C+	2C+	2C-	2C-	2C-	2C-	
Relative Altitude			3C			2B+	2B+	2B+	2B+	2B	2B	2B+	2B+	
Longitudinal Hover Position		2D				2C+	2C+	2C	2C	2C	2C	2C	2C	
Lateral Hover Position	2D					2C+	2C+	2C+	2C+	2C	2C	2C	2C	
Hover Azimuth Error				1B		2C+	2C+	2C+	2C+	2C	2C	2C	2C	
Deck Status*					1	1+	1+	1+	1+	1+	1+	1+	1+	
Ship Motion	2C	2C	2C			1C+	1C+	NA	NA	2C	2C	NA	NA	
Wave off					3	3+	3+	NA	NA	3+	3+	NA	NA	
Horizontal Reference	1B	1B	1B			1C+	1C	1C+	1C	1C-	1C=	1C	1C-	
Hover Height			1C			1C+	1C-	1C+	1C	1C-	1C=	1C	1C-	
Closure Rate Error		2B				1B	1B	1B	1B	1A-	1A-	1A	1A-	
Aircraft Flight Instruments														

* Voice Communications/ LSO ratings not included

Not Visible - NV
Strong source - +
Moderate source - blank
Weak source - -
Very weak source - =

Figure 3-15. Summary of Information Required versus Information Provided for AV-8A - Hover Segment

Information Required	Information Provided													
	LEVEL/TYPE					Condition								
						Day				Night				
						Shipboard		Shorebased		Shipboard		Shorebased		
	LATERAL	LONG./SPD.	VERTICAL	AZIMUTH	INSTRUCT.	VFR	IFR	VFR	IFR	VFR	IFR	VFR	IFR	
Identity														
Inbound Heading														
Base Recovery Course														
Ship Course Ambiguity														
Pattern Orientation														
Pattern Dimensions														
Relative Wind*	3B	3B	$\overline{3}$B	3B										
Signal Delta/Charlie														
Range														
Range Rate														
Time-to-turn Milestone														
Lateral Tracking Error														
Approach Slope Tracking Error														
Range Milestone														
Obstacle Clearance	$\overline{3}$B	$\overline{3}$B	$\overline{3}$B	$\overline{3}$B		2C	2C	2C	2C	2C	2C	2C	2C	
Relative Altitude														
Longitudinal Hover Position		3D				2C+	2C+	2C+	2C+	2C	2C	2C	2C	
Lateral Hover Position														
Hover Azimuth Error				1B		2C+	2C+	2C+	2C+	2C	2C	2C	2C	
Deck Status														
Ship Motion	2D	2D	2D			2C+	2C	2C+	2C	NA	NA	NA	NA	
Wave off														
Horizontal Reference	1B	1B	1B			1C+	1C-	1C+	1C	1C-	1C=	1C	1C-	
Hover Height			1D			1C+	1C+	1C+	1C+	1C-	1C-	1C-	1C-	
Closure Rate Error														
Aircraft Flight Instruments														

* Voice Communications/ LSO ratings not included

Not Visible - NV
Strong source - +
Moderate source - blank
Weak source - -
Very weak source - =

Figure 3-16. Summary of Information Required versus Information Provided for AV-8A - Vertical Landing Segment

warning if the pilot strays too far to port or starboard of the desired path. As the pilot comes into a hover over the landing area, however, he loses site of most of the line-up display.

The view of the ship fails to provide the level of information desired by pilots with regard to both relative altitude and closure rate. The view of the ship/field is even less satisfactory at night.

4. Longitudinal Hover Position, Lateral Tracking Position, Hover Azimuth Error, and Hover Height - The centerline markings and lights provide satisfactory hover azimuth error. However, the markings and lights only provide a sense of error rate of change as opposed to the change in error rate of change desired for lateral and longitudinal hover position. Consequently, the pilot must watch to see the error, wait to see the amount of change and watch to see the extent of change in rate of change. As a result of this situation it appears that a more instantaneous method is required. With regard to hover height, it appears that the level of information desired increases as the pilot moves into the vertical landing segment. The existing sources for hover height information only provide a degree of error rate of change.

5. Obstacle Clearance - The view of obstacles themselves provides at best a task limit warning but not the desired safety limit warning. No device currently warns the pilot of an impending collision with an obstruction. It is assumed that as a part of the marking criteria that if the pilot hovers correctly he will not contact any obstacles.

6. Deck Status and Wave-Off - It appears that the rotary beacon signal light and wave-off lights more than adequately provide the necessary instructional data to the pilot provided they are installed in a location where they can be readily observed.

7. Ship Motion and Horizontal Reference - The view of the ship both during the day and at night does not provide the type of ship motion information needed, although ship motion on large aviation ships is not considered a significant problem. The horizontal reference provided by the ocean is a strong source during the day but becomes a weak source during the night and even a weaker source as meteorological conditions approach minimums. Additional horizontal reference information is, therefore, needed.

SECTION IV. CONCLUSIONS, PERFORMANCE REQUIREMENTS AND RECOMMENDATIONS

This section is divided into three parts. The first part provides the overall conclusions of the study and emphasizes the basic findings of the study. The second part identifies VLA performance requirements for homing/orientation/initial approach, final approach and hover/vertical landing. The requirements stem from the deficiencies resulting from the comparison of existing VLA sources versus information requirements. The third part discusses the recommendations of the study.

A. CONCLUSIONS

1. The methodology developed for classifying information requirements by the segments, levels and types of vertical, lateral, speed/longitude, azimuth data is workable.

2. Use of the methodology in surveying pilot information requirements tends to eliminate the subjectiveness and biases often found when the pilot is specifically questioned about the need for a particular device.

3. The type of operations conducted, number of flight hours logged and conditions under which the pilot experience had been gained proved to be an insignificant factor in survey responses.

4. There are only minor differences between the categories of information required for:

   a. Helicopter operations versus AV-8 operations, including different types of helicopters.

   b. Aviation ship operations versus air capable ship or tactical site operations.

   c. Landing operations versus VERTREP, HIFR or SLED.

5. The differences in information required for particular aircraft, ship types or operations were reflected in the levels and types of data needed as opposed to the category of information (relative wind, ship motion, etc.) required.

6. The pilots surveyed often indicated the importance of the information by increasing the level and type of information desired.

7. The requirement to operate at NAVTOLAND minimums of zero ceiling and 700' visibility eliminates the need to conduct the homing, orientation, initial approach and final approach segments visually. The visual requirements for conducting normal VFR or IFR

operations are, in many cases, more stringent than the visual requirements for conducting low visibility operations.

B. PERFORMANCE REQUIREMENTS

1. Homing, Orientation and Initial Approach

a. A homing device is needed with sufficient intensity to be seen in all VFR conditions and normal IFR. The device should also enable pilots to differentiate one ship from another.

b. Develop a visual device, procedure (including pre-briefing) or combination thereof which will enable the pilot to receive basic approach and landing information under EMCON and emergency conditions.

c. Develop a device or concentrate on methods of illuminating the ship which enables the pilot to properly position the aircraft with respect to altitude and the orientation and down wind leg of the initial approach.

2. Final Approach

a. Develop a VLA device which provides both vertical and lateral tracking error information. The device should be visible for a 3 to 4 mile distance under normal VFR conditions and provide safety limit warnings when the pilot has strayed from the desired flight path. The device should be stabilized to the extent that operations are required (sea state 5 for NAVTOLAND) and provide a lateral and vertical beam spread commensurate with the desired flight envelope.

b. Develop a VLA device or combination VLA device/tracking system which provides closure rate error information. The device or procedure should concentrate on providing the information when the aircraft is from 3 to 4 miles from the ship to the commencement of transition to hover.

c. Review intensity capacities and beam spreads of deck status, wave-off, glide slope indicator, and line-up lights to determine the feasibility of making them visible during the commencement of the final approach.

d. Develop a VLA device or procedure (including pre-flight briefing) which will effectively enable visual communication of instructional information such as relative wind and base recovery course while under EMCON or emergency conditions.

3. Hover and Vertical Landing

a. Develop a more meaningful VLA technique for measuring relative wind and providing the information to the pilot.

b. Develop a VLA device which will enable the pilot to accurately determine actual position versus ideal position with respect to lateral, vertical and longitudinal displacement. Some form of warning should be incorporated to indicate the limits of the flight envelope. Special consideration should be given to helicopter VERTREP, HIFR and SLED operations requiring continuous hover and V/STOL operations requiring hover in aircraft with minimum stability.

c. Provide a means of indicating to the pilot when he becomes dangerously close to an obstruction.

d. Develop increased horizon reference cues, particularly at night.

C. RECOMMENDATIONS

1. The VLA performance requirements identified herein should be used as a guide for defining and formulating the concepts needed to satisfy NAVTOLAND project goals and general VFR/IFR conditions for both helicopter and V/STOL aircraft. Of particular importance is information required for determining:

a. Identification of ship
b. Vertical and lateral tracking error.
c. Closure rate and range milestone
d. Hover position and horizon

2. The methodology and evaluation techniques developed as a result of this study should be used whenever new aircraft/site combinations are proposed. The approach should consist of:

a. Developing a pilot information requirements matrix for the envisioned combinations.

b. Evaluating existing lighting, marking and other visual cue sources to determine deficient areas.

c. Developing new VLA based on the deficient areas.

3. Further work in the area of information requirements should concentrate on determining:

a. The effectiveness of individual VLA devices in providing visual cues to the pilot.

b. The efforts of VLA devices interacting in combination with each other.

c. The sensitivity requirements of the information identified by the pilots.

d. The use of integration of VLA devices with landing guidance, tracking systems and aircraft displays.

e. The adequacy of intensity and beam spreads of existing lights.

SECTION V. TERMINOLOGY

The following terminology was developed and used as a basis for the survey.

A. INFORMATION LEVELS

There are three information levels, identified by the numbers 1, 2, 3 and $\overline{3}$, used to convey the opinion of how important an information requirement is and, in the same sense, the priority of the information. In addition, information levels are also intended to convey the consequences of not having the information.

1. Information Level 1. This is the level of information required for task control. An example of this type of information is the position of the "meatball" with respect to the datum arms of an optical landing system, such as the FLOLS. The displacement of the meatball indicates the direction and magnitude of the deviation from glide slope and the movement of the meatball indicates whether the aircraft is approaching or departing the glide slope and the speed with which this change is taking place. Information at Level 1 may also be purely instructive.

2. Information Level 2. This level of information indicates the limit of task control. It includes information of Level 1 and in addition includes a warning which says, "Do something or you will have to wave-off." An example of Level 2 information is the red color of the meatball of the FLOLS at the lower limit of its coverage.

3. Information Level 3. This level of information indicates a safety limit. It includes the information of Levels 1 and 2, and in addition includes a warning that the limits of safety are being approached and that something must be done immediately to avoid an accident. Thus, flashing the red, too-low meatball of the FLOLS if the aircraft were approaching the extreme lower limit of the signal would be information of Level 3.

4. Information Level $\overline{3}$. This level of information commands immediate action without explanation. It does not include information of Levels 1 and 2. Examples of information of Level $\overline{3}$ are the wave-off and cut signals of the FLOLS.

Information levels are also needed for "instructive" information. In this sense, the open-loop type of data that the pilot requires to make his approach to his destination should be considered from the viewpoint of the consequences of not having it. If the consequences of not having a particular bit of information is, in the opinion of the pilot, that he would not be able to perform the task at hand, but that there was no particular connotation of hazard to not being able to perform the task, that bit of information should be classed as Level 2. If, on the other hand, the absence of that particular piece of information would create a hazard, the information under consideration should be classified as Level 3. Information that is neither Level 2 or Level 3, is Level 1, because it relates only to task control.

B. TYPES OF INFORMATION

There are four types of information designated by the letters A, B, C, and D. In dealing with errors, there is a point where there is no error, or where the error is within an acceptable tolerance. This is called the "error null."

1. Type A, Error Direction. Once the error goes beyond the null, the first bit of needed information is the direction of the error. Note that "Error Direction" conveys no "Magnitude" data. The information requirements have been termed in such a way as to reflect the various axes in which the pilots exerts control, so there is an error null with respect to distance or range, to speed, to the lateral track and to the vertical track. An example of the indication of an error null is the yellow on-glide slope indication of the GSI. The red LOW signal and the green HIGH signal indicate only direction of departure and are thus Type A information.

2. Type B, Error Magnitude. The next type of information that is required is that which tells how far from the null the aircraft has strayed -- in other words, "Error Magnitude." An example of this type of information is the displacement of the meatball of the FLOLS above or below the datum error. Note that Type B information also includes the error direction, Type A, information.

3. Type C, Error Rate of Change. If the trend of error magnitude were observed over a period of time, one could see the amount of error change within that time period; therefore, the rate of change of error changes. The perception of this rate of change would be greatest when the variation of magnitude is the greatest over the smallest period of time. It is this "Rate of Error Change" that makes up our Information Type "C". An example of this type of information is the movement of the meatball of the FLOLS. This type of information can also be indicated directly. For example, the vertical speed indicates rate of change of altitude.

4. Type D, Change in Error Rate of Change. To obtain a stable error null, it is necessary to have change error rate-of-change of information. This type of information is Type D information. The error magnitude, the rate-of-change of error, and the change of rate-of-change must be reduced to zero simultaneously in order to obtain a stable null.

At this point, it is appropriate to think of Error Types in terms of the practical experience in the hovering regime of flight. For example, assume that you are hovering over a point and note that you have started to drift to the right. You can see the approximate magnitude of your error, and the rate at which the error is accumulating. When you apply control to first stop the drift, and then move back over the hovering point, you perceive the change in the rate of change of that error through the point at which it becomes zero at the extreme of the deviation; then increases in the opposite direction until you are about over the hover point, at which time you again gradually change the error rate-of-change so that you can resume a stationary hover over the desired position.

Now assume that you are performing the same exercise in a black night in which you have no references except for those provided by your flight instruments. If you were asked what you needed at this point, you would all assume that your most desirable aid would be simply to floodlight the area so that you could see the hover point as you see it in daylight, but just suppose that such was not possible. Now what kind of information would you like to have?

C. INFORMATION REQUIREMENT ITEMS

The information requirements which are rated by levels and types are explained below. The numbers of the requirements listed correspond to the numbers used on the evaluation forms. Items i through n develop somewhat different procedures when applied to a racetrack approach pattern. Therefore, they are considered as applied to a straight-in approach in part 1 of this paragraph and as a racetrack pattern in part 2.

1. Items for Straight-In Approach

a. Identity

(1) Discriminate own vessel from empty field or from other ships

b. Inbound Heading

(1) Determine compass heading to steer to overfly ship or to reach holding, Delta, marshall
(2) (Remember - relative crosswinds over long distances)

c. Base Recovery Course

(1) As distinguished from PIM, Fox Corpen or present course

d. Ship Course Ambiguity

(1) Which end is which?

e. Pattern Orientation - Turning over ship/fix to gate, marshall, hold, etc.

(1) Know first heading after station passage or divert from inbound
(2) Heading for structured approach pattern, recognizing

- other traffic
- delays in Delta, holding
- GRILS/LVA/HOBR monitoring
- marginal IMC/VMC

f. Pattern Dimensions

(1) Plan for pattern turns

g. Relative Wind

(1) Relative navigation
(2) Crab/slideslip requirements on final approach
(3) Gross weight limits/single engine in hover

h. Signal Delta/Charlie

(1) Clearance/delay time

i. Range

(1) Distance from PIL before final approach

j. Range Rate

(1) Trend and rate of range before final approach

k. Time-to-Turn Milestone

(1) Actual time for turns in structured approach
(2) Most critical on turn to final approach

l. Lateral Tracking Error

(1) Error to null
(2) Displaces heading requirement on final approach

m. Approach Slope Tracking Error (include ∅ slope

(1) Error to null
(2) Vertical clearance factors
(3) Replaces altitude requirement on final approach

n. Range Milestone (Final Approach)

(1) Closure rate adjustment
(2) Stimulate control functions (i.e., duct angles, reduce airspeed)

o. Closure Rate Error

(1) Relative speed tolerance (null tolerance varies between pilots)
(2) Narrowing tolerances with distance closure

p. Obstacle Clearance

(1) Visual data prior to encountering physical carrier

(a) Remote from physical barrier, perhaps (i.e., painted outlines)

q. Relative Altitude

(1) Altitude while outboard of ship structure (assures vertical clearance
(2) Datum-cursor relationships per terrain or superstructure and horizon, etc.
(3) Converts to hover height over ship or pad

r. Longitudinal Hover Position Error

(1) In longitudinal approach, approach null
(2) In lateral approach, maintain null
(3) Station keeping prior to and during vertical landing

s. Lateral Hover Position Error

(1) In lateral approaches, approach null
(2) In longitudinal approach, maintain null
(3) Station keeping prior to and during vertical landing

t. Hover Azimuth Error

(1) Visual aid in event of heading hold casualty

u. Deck Status

(1) If foxtrot 2-blocked, or green-light, deck in all respects safe and ready. FOD walk-down complete, LSE, fire suits, etc.

v. Ship Motion

(1) Potential for virtual horizon data

(2) NATOPS/personal/special limits

(a) Recommendations to con

(3) Null prediction

w. Wave-off/cut (need additional item: cause)

(1) Advisory, precautionary or hazard
(2) Should include cause

(a) A/C conditions, procedures, deck/ship conditions

(3) Power calls

x. Horizon Reference

(1) Pilot orientation (roll, pitch)
(2) Ship motion correlation (roll, pitch, heave, etc.)

y. Hover Height

(1) Absolute vertical clearance dimension, consideration of both A/C and ship motion
(2) Control of vertical descent
(3) A/C over ship/pad

z. A/C Flight Instruments - All applications

2. Application to Racetrack Pattern (Items i - n)

The items listed above are directly applicable to the straight-in approach. Some modifications in meaning are required to accommodate the "racetrack" pattern. These differences are discussed below.

i. Range. This factor is adjusted to define the distances abeam of the aircraft from the ship, while flying upwind for break, and on the downwind leg, preparatory to making the final approach turn at the 180 degree position.

j. Range Rate. This refers to the rate of change in range.

k. Time-To-Turn Milestone. The positions for the turn to the downwind leg, and for the beginning of the final approach at the 180 degree position.

l. Lateral Tracking Error. Since there are no occasions in the racetrack approach within which the aircraft is tracking on a straight line toward the Point of Intended Landing (PIL), Lateral Tracking Error is a misnomer for application in the usual

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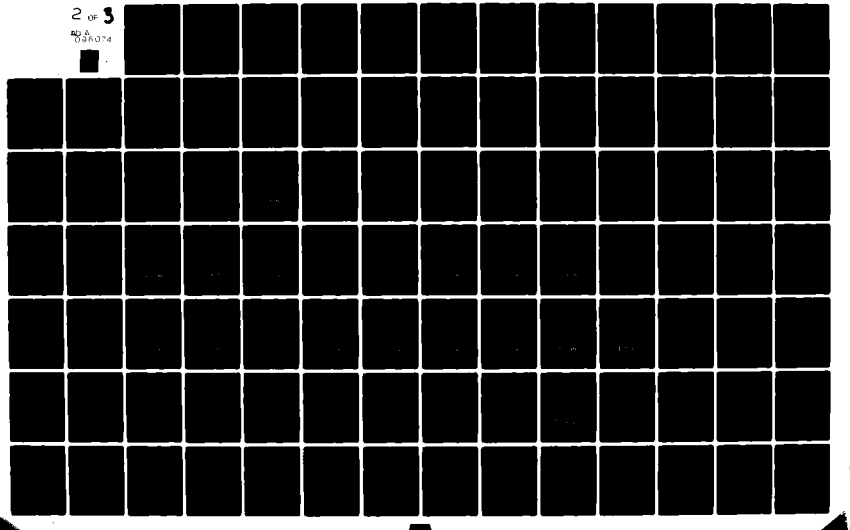


sense. There is not a serious concern for lateral position until the last half of Segment Three, when the abeam range must be adjusted to assume a proper 180 degree position. The tracking task, itself, is a function of both "range," and "range rate," themselves purely instructive items since there is no feasible consideration of a closed-loop task in this segment.

For a given set of circumstances, described by the altitude and air speed of the helicopter, the relative wind, and the assigned LPH/LHA landing spot, there is but one position from which an approach can be flown with a constant, prescribed angle of bank, airspeed and rate of descent, to arrive at a prescribed point in space, on the projection of the 45 degree reference line of the landing spot. A pilot usually begins his approach as close to that point as he can, but in most instances finds that he must adjust his horizontal position by using continuous observations of progress toward the PIL, with a sense of lateral positioning with respect to the ideal path relative to his destination. In this sense, he performs "lateral tracking," using the integrated set of cues which emanate from his view of the landing site. It is the enhancement of this set of cue sources to which this information requirement is directed.

m. Approach Slope Tracking Error. The slope aspect of a racetrack pattern is really a concern for flying level at an appropriate altitude on the downwind leg (Segment 3) and with a consistent rate of descent while turning in the final approach (Segment 4A and 4B) in a manner that should remove the hazard of inadvertently descending into the water. Since altitude data is extracted primarily from flight instruments on the downwind leg, and the shift is made to visual means, progressively, during the early part of Final Approach, the first concern for the visual acquisition of data is in Segment 4A, then continuing through Segment 4B. In order to remove the "straight-in" connotation to this term, the term itself is revised to "Vertical Tracking Error" in conformance to specific recommendations from interviewed Marine pilots.

n. Range Milestone. Originally intended as the designation of a specific range at which functions such as check list items or airspeed changes were to occur, this is not in this style approach so much a function of range as it is a function of position. It is a "Functional Milestone," and the nomenclature is changed appropriately.

D. AXIS OF APPLICATION AND INSTRUCTIVE INFORMATION

Each approach segment is subdivided into categories of information termed "axis of application." This is done to ensure all flight parameters (lateral, vertical and speed/longitudinal) are covered within each segment of the approach. The term, "instructive", is provided to include general, informative data such as ship's course and speed, relative wind, etc.

SECTION VI. PILOT SURVEY OF INFORMATION REQUIREMENTS

This section provides the results of the pilot survey of information requirements. The information requirement categories and suggested ratings are indicated for each segment of the approach, along with the number of pilots which agreed or disagreed with the rating and any comments. Ratings which are circled indicate those that were suggested in the survey questionnaire, whereas ratings which are enclosed in a triangle were suggested by one or more pilots. Ratings enclosed in a square symbol were those considered to represent the actual requirement. The survey involved information requirements for the following aircraft and ship/shore combinations:

1. USN H-2 operating from Combatants, Figure 6-1 with 6 segments.
2. USN H-2 conducting HIFR Operations, Figure 6-2 with 1 segment.
3. USN H-46 conducting HIFR Operations, Figure 6-3 with 1 segment.
4. USN H-46 operating from Auxiliaries, Figure 6-4 with 6 segments.
5. USN H-46 operating from Combatants, Figure 6-5 with 6 segments.
6. USN H-53 operating from LPD's, Figure 6-6 with 6 segments.
7. USN H-53 conducting MK 105 SLED operations, Figure 6-7 with 2 segments.
8. USN H-53 conducting LPD MK 105 SLED operation, Figure 6-8 with 5 segments.
9. USN H-53 conducting MK 105 operations, Figure 6-9 with 5 segments.
10. MC UH-1/AH-1 operating from LPH/LHA's, Figure 6-10 with 6 segments.
11. MC H-46 operating from LPH/LHA's, Figure 6-11 with 6 segments.
12. MC H-53 operating from LPH/LHA's, Figure 6-12 with 6 segments.
13. MC H-1/H-46/H-53 operating from LPH/LHA's, Figure 6-13 with 6 segments.
14. MC H-1/H-46/H-53 operating from Landing Zones, Figure 6-14 with 6 segments.
15. MC H-1/H-46/H-53 operating from Landing Zones, Figure 6-15 with 6 segments.
16. MC H-1/H-46/H-53 operating from Landing Zones, Figure 6-16 with 6 segments.
17. MC AV-8A operating from LPH/LHA's, Figure 6-17 with 6 segments.
18. MC AV-8A operating from Tactical Sites, Figure 6-18 with 6 segments.

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Change in Error Rate-Of-Change

No. Of Pilots: 18

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					(1)	9/9	•Vertical clearance identity essential. Most concerned with	
2	Inbound Heading	(1E)					16/2	identity of getting on top of ship.	
3	Base Recovery Course					(1)	14/4	•LN 66 used for this purpose. If BRC known - not necessary.	
4	Ship Course Ambiguity					(1)	11/7	•Ship's course used to plan approach outbound.	
5	Pattern Orientation					(1)	14/4	•Orientation derived from ambiguity.	
6	Pattern Dimensions					(1)	14/4	•Should be standardized.	
7	Relative Wind					(1)	15/3	•Must know prior to landing to ensure ship has provided envelope.	
8	Signal Delta/Charlie					(1)	13/5		
9	Range					(1)	16/2	•Fuel considerations - BINGO. Are you clear for approach.	
10	Range Rate					(1)	16/2		
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	14/4	•Not required during this phase.	(1.) 5, Level #1 Instructive
21	Ship Motion					(1)	6/- (1)		1, Level #1A Speed Long'l.
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)			18/0	•For information only.	
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-1-1. USN H-2 Survey of Pilot Information Requirements - Operating from Combatants, Segment 1 - Homing

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 19

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					△2	1/-		
2	Inbound Heading								
3	Base Recovery Course					○1	15/4	•First thing to determine. Not needed. Base recovery course	
4	Ship Course Ambiguity					○1	12/7	enough. Essential from overhead out.	
5	Pattern Orientation					○1	16/3	•Standard.	
6	Pattern Dimensions					○1	16/3	•Standard.	
7	Relative Wind					○1	17/2	•Important for developing envelope.	
8	Signal Delta/Charlie					○1	15/4	•Must be expedited for fuel purposes.	
9	Range					○1	18/1		
10	Range Rate					○1	17/2		
11	Time-To-Turn Milestone					○1	17/2	•"Expeditious safety" is watchword.	
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					○1	13/6	•If red deck, how long until green. Would attempt to obtain	
21	Ship Motion					△A	5/-	prior to approach.	
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	○C	○B	○C			19/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-1-2. USN H-2 Survey of Pilot Information Requirements - Operating from Combatants, Segment 2 - Orientation

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 19

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					△2	1/-		
2	Inbound Heading								
3	Base Recovery Course					○1	12/7		
4	Ship Course Ambiguity					△2	1/-	5.•Particularly at night important to be set-up properly to avoid	
5	Pattern Orientation					○1	12/7	abrupt control of aircraft in segment 4 & 5.	
6	Pattern Dimensions					○1	15/4	6.•Standardized.	
7	Relative Wind					○1	13/6	7.•Proper flight envelope needed for planning purpose.	
8	Signal Delta/Charlie					○1	13/3 (1.)		(1.) 3 Deletions
9	Range					○1	15/4		
10	Range Rate					○1	15/4		
11	Time-To-Turn Milestone					○1	14/5		
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone					△2	1/-		
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					○1	8/11	•Provided w/signal delta. Would have already determined.	
21	Ship Motion					○1	4/15		
22	Wave Off					△2	1/-		
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	○1C	○1B	○1C			19/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-1-3. USN H-2 Survey of Pilot Information Requirements - Operating from Combatants, Segment 3 - Initial Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Change in Error Rate-Of-Change

No. Of Pilots: 18

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind					(1)	13/5	•What type winds. Proper envelope ensured.	
8	Signal Delta/Charlie					△	2/- (1.)		
9	Range					△	2/- (2.)		
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	2B					18/0		
13	Approach Slope Tracking Error			3B			17/1	•Not so critical in 4A.	
14	Range Milestone					(1)	16/2		
15	Obstacle Clearance								
16	Relative Altitude			△ 3B			1/-		
17	Longitudinal Hover Position								(1.) 1, Level #1,
18	Lateral Hover Position								1, Level #2
19	Hover Azimuth Error								(2.) 1, Level #1
20	Deck Status					(1)	14/4	•Clear to continue. Nice to know.	1, Level #2
21	Ship Motion					△	7/- (3.)		(3.) 5, Level #1,
22	Wave Off					(1)	15/3		2, Level #2
23	Horizontal Reference					△	3/- (4.)		(4.) 2, Level #1
24	Hover Height								1, Level #2
25	Closure Rate Error		1B				16/2	•Begin to adjust for fast/slow closure.	
26	Aircraft Flight Instruments	1C	1B	1C			18/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-1-4A. USN H-2 Survey of Pilot Information Requirements - Operating from Combatants, Segment 4A - Final Initial Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Change in Error Rate-Of-Change

No. Of Pilots: 20

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course					□ 1	19/1	•Must have correct relative wind by this point. Should be known	
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind					□ 1	14/6	•Aircraft becoming slow & very susceptible to adverse wind en-	
8	Signal Delta/Charlie					△	2/- (1.)	velope. Early warning necessary to correct aircraft heading.	
9	Range							Where are your winds? What will they do to me?	
10	Range Rate								
11	Time-To-Turn Milestone								(1.) 2, Level #1 Instructive
12	Lateral Tracking Error	□ 2B					20/0	•O.K.	(2.) 5, Level #1
13	Approach Slope Tracking Error			□ 3C			20/0	•Right!!	2, Level #2D
14	Range Milestone					□ 2	18/2		
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					□ 1	15/5	•Must begin to think of wave-off if ship not ready to recover	
21	Ship Motion					△	7/- (2.)	aircraft. Concerned with possible change in status. Unsafe to	
22	Wave Off					□ 3	20/0	fly approach to unknown deck status from this point on.	
23	Horizontal Reference	□ 1C	□ 1C				20/0	23. •Visual on ship mandatory.	
24	Hover Height								
25	Closure Rate Error		□ 1B				13/7	•Compensate for fast closure. Approaching critical.	
26	Aircraft Flight Instruments	□ 1C	□ 1B	□ 1C			19/1		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-1-4B. USN H-2 Survey of Pilot Information Requirements - Operating from Combatants, Segment 4B - Final Close-In Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Change in Error Rate-Of-Change

No. Of Pilots: 20

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE		PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity									
2	Inbound Heading									
3	Base Recovery Course									
4	Ship Course Ambiguity									
5	Pattern Orientation									
6	Pattern Dimensions									
7	Relative Wind	3C	3C	3C	3C		19/1	(1.)	•Normally brief that optimum winds will be given in this situation or ship will talk to you for safety sake, usually not that concerned with wind. Vert not 3. Power not a problem with both engines functioning. Rate & rate change. Wave-off information for this phase is critical since you are close in to landing area. This phase terminates in hover so it is a most critical area regarding vehicle changes and closure rates.	(1.) Vertical (only 13/7)
8	Signal Delta/Charlie									(2.) 4, Level #3C
9	Range									(3.) 20/0
10	Range Rate									(4.) 4, Level #3D
11	Time-To-Turn Milestone									(5.) 5, Level #3D
12	Lateral Tracking Error	2C					16/4	(2.)		(6.) 3, Level #3D
13	Approach Slope Tracking Error									2, Level #3D
14	Range Milestone									(7.) 3, Level #2B
15	Obstacle Clearance	3B	3B	3B			20/0	(3.)		(8.) 7, Level #2,
16	Relative Altitude			3C			14/6	(4.)	• Where is the obstruction in relation to A/C heading over deck edge.	2, Level #3
17	Longitudinal Hover Position		2D				15/5	(5.)	•Azimuth line-up essential in safe operation over an FF Class ship. Change made to reflect that seg 5 doesn't terminate until over touchdown spot.	(9.) 1, Level #3C Speed/Long'l.
18	Lateral Hover Position	2D					15/5	(6.)		(10.) 2, Level #2B (All)
19	Hover Azimuth Error				0B		17/3	(7.)		(11.) 3, Level #2C Vertical
20	Deck Status					(1)	11/9	(8.)	•Status must be known in order to either proceed to segment 6 or wave-off & back to segment 3. Pilot would wave-off if no info.	(12.) 7, Level #3B,
21	Ship Motion	2C	2C	2C			20/0	(9.)		2, Level #3C
22	Wave Off					3	20/0		If ship not ready to accept, aircraft must wave-off.	(13.) 1, Level #3B Vertical
23	Horizontal Reference	1B	1B	1B			17/3	(10.)	•You are out of balance - important for orientation.	1, Level #2B Vertical (only)
24	Hover Height			1C			17/3	(11.)		
25	Closure Rate Error		2B				11/9	(12.)	•Critical close to ship. Don't close on the hangar. Close-in to the ship aircraft must be sure that closure rate has been arrested in order not to make large control movement.	
26	Aircraft Flight Instruments	2B	1A	2B			19/1	(13.)		
	Special Info. Req'd. Cat.									
27	Density Altitude									
28	VERTREP Load Data								26.• Only looking at radalt.	
29	Aircraft Separation									
30	HIFR Status									
31	Skew/Tension Indications									
32	Sled Status									

Figure 6-1-5. USN H-2 Survey of Pilot Information Requirements - Operating from Combatants, Segment 5 - Hover

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Change in Error Rate-Of-Change

No. Of Pilots: 20

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	3B	3B	3B	3B		19/1	• Normally, brief that the optimum wind will be given in situation or ship will talk to you for safety sake. Not that concerned with wind. See Segment 5. Same as segment 5-3B/ Power not a problem with both engines.	
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	3B	3B	3B	3B		20/0		(1.) Presented on original matrix but not included in pilot validation survey.
16	Relative Altitude								(2.) Same as above.
17	Longitudinal Hover Position		3D				19/1	*Don't have time to see change rate of change	
18	Lateral Hover Position	3D					19/1	•" "Items 17 & 18 concur.	
19	Hover Azimuth Error				1B		10/10		
20	Deck Status					(1)	(1.)		
21	Ship Motion	2D	2D	2D			14/6	• Affects hover stability. Concerned with motion for safety. Certain ship motion is beyond limits of ship & A/C pilots.	
22	Wave Off					3	(2.)		
23	Horizontal Reference	1B	1B	1B			17/3	•Critical with moving deck.	
24	Hover Height			1D			11/9	•Ship roll/pitch can affect hover. Low or high information is required to maintain hover. Hover height is critical. Deck & aricraft are moving.	
25	Closure Rate Error								
26	Aircraft Flight Instruments								
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-1-6. USN H-2 Survey of Pilot Information Requirements - Operating from Combatants, Segment 6 - Vertical Landing

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Change in Error Rate-Of-Change

No. Of Pilots: 4

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE		PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity									
2	Inbound Heading									
3	Base Recovery Course									
4	Ship Course Ambiguity									
5	Pattern Orientation									
6	Pattern Dimensions									
7	Relative Wind	△ 3B	△ 3B	△ 3B	△ 3B		4/0	(1.)		
8	Signal Delta/Charlie									
9	Range									
10	Range Rate									
11	Time-To-Turn Milestone									
12	Lateral Tracking Error									(1.) 0, Level 3B Vertical (Not Validated)
13	Approach Slope Tracking Error									(2.) 1, Level #2D Speed/Long'l.
14	Range Milestone									(3.) 1, Level #2D Lateral
15	Obstacle Clearance	△ 3B	△ 3B	△ 3B	△ 3B		4/0			(4.) 1, Level #2C Speed/Long'l.
16	Relative Altitude									1, Level #2C Azimuth
17	Longitudinal Hover Position		△ 3D				3/1	(2.)		1, Level #1B Azimuth
18	Lateral Hover Position	△ 3D					3/1	(3.)		(5.) 3, Level 2 Lateral, Speed/Long'l. & Vertical
19	Hover Azimuth Error				(1B)		1/-	(4.)		
20	Deck Status									
21	Ship Motion	△ 2C	△ 2C	△ 2D			2/2			
22	Wave Off					△ 3	4/0			
23	Horizontal Reference	△ 1B		△ 1B			1/-	(5.)		
24	Hover Height			△ 2D			2/2			
25	Closure Rate Error									
26	Aircraft Flight Instruments									
	Special Info. Req'd. Cat.									
27	Density Altitude									
28	VERTREP Load Data									
29	Aircraft Separation									
30	HIFR Status									
31	Skew/Tension Indications									
32	Sled Status									

Figure 6-2-1. USN H-2 Survey of Pilot Information Requirements - HIFR, Segment 5 - Hover

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Change in Error Rate-Of-Change

No. Of Pilots: 3

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	3B	3B	3B	3B		3/0		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	2C					2/1		
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	3B	3B	3B	3B		3/0		
16	Relative Altitude			3C			2/1		
17	Longitudinal Hover Position		2D				2/1		(1.) Except for 2/1 Speed/Long'l.
18	Lateral Hover Position	2D					2/1		
19	Hover Azimuth Error				1B		1/2		
20	Deck Status (HIFR Status)					1			
21	Ship Motion	2C	2C	2D			3/0		
22	Wave Off					3	1/2		
23	Horizontal Reference	1B		1B			3/0		
24	Hover Height			3B			1/2		
25	Closure Rate Error		2B				2/1		
26	Aircraft Flight Instruments	2B	1B	2A			1/2 (1.)		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-3-1. USN H-46 Survey of Pilot Information Requirements - HIFR, Segment 5 - Hover

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Change in Error Rate-Of-Change

No. Of Pilots: 9

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					(2)	7/2	•H-46 very range-end limited. Must go to right place prior to	
2	Inbound Heading	(1B)					9/0	fuel go-no-go situation. Critical on long missions. Fuel limit.	
3	Base Recovery Course					(1)	9/0	•Multi ship operations.	
4	Ship Course Ambiguity					(1)	9/0		
5	Pattern Orientation					(1)	8/1	•Confusion.	
6	Pattern Dimensions					(1)	9/0		
7	Relative Wind					(1)	9/0		
8	Signal Delta/Charlie					(1)	6/3	•Endurance - know ahead of time. Time required to satisfactory	
9	Range					(1)	9/0	act. Fuel consideration. Depend on fuel state at start of	
10	Range Rate					(1)	9/0	approach.	
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude			△3C			1/-	•May be included in flt. inst. warning.	
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	9/0		
21	Ship Motion					△1	2/-		
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)			6/3	•Rate not factor in homing.	
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data					△1	2/-	•Need to know for mission. Load weight limitations.	
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-4-1. USN H-46 Survey of Pilot Information Requirements - Operating from Auxiliaries, Segment 1 - Homing

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Change in Error Rate-Of-Change

No. Of Pilots: 9

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course					(1)	9/0		
4	Ship Course Ambiguity					(1)	9/0		
5	Pattern Orientation					(1)	9/0		
6	Pattern Dimensions					(1)	9/0		
7	Relative Wind					(1)	9/0		
8	Signal Delta/Charlie					(1)	7/2	•Fuel	
9	Range					(1)	9/0		
10	Range Rate					(1)	8/1	•Fuel	
11	Time-To-Turn Milestone					(1)	9/0		
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance					△1	2/-	•Clearance when over-flying. Ext. load increase hover act -	
16	Relative Altitude			△3C			1/-	clearance required.	
17	Longitudinal Hover Position							16.• May be included in flt. inst.	
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	9/0		
21	Ship Motion								
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)			9/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-4-2. USN H-46 Survey of Pilot Information Requirements - Operating from Auxiliaries, Segment 2 - Orientation

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Change in Error Rate-Of-Change

No. Of Pilots: 9

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					△1	1/-		
2	Inbound Heading					△1	2/-	•Need this information.	
3	Base Recovery Course					○1	9/		
4	Ship Course Ambiguity					△1	1/-		
5	Pattern Orientation					○1	9/0		
6	Pattern Dimensions					○1	9/0		
7	Relative Wind					○1	8/1		
8	Signal Delta/Charlie					○1	8/1		
9	Range					○1	9/0		
10	Range Rate					○1	9/0		
11	Time-To-Turn Milestone					○1	9/0		
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance					△1	1/-		
16	Relative Altitude					△1	2/- (1.)	•May be included in flt. insts. warning.	(1.) 1, Level 1 1, Level 3C Vertical
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					○1	9/0		
21	Ship Motion								
22	Wave Off					△1	1/-		
23	Horizontal Reference								
24	Hover Height					△1	1/-		
25	Closure Rate Error					△1	1/-		
26	Aircraft Flight Instruments	○1C	○1B	○1C			9/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data					△1	1/-		
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-4-3. USN H-46 Survey of Pilot Information Requirements - Operating from Auxiliaries, Segment 3 - Initial Approach

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Change in Error Rate-Of-Change

No. Of Pilots: 9

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					(1)	2/-		
2	Inbound Heading					(1)	2/-		
3	Base Recovery Course					(1)	1/-		
4	Ship Course Ambiguity					(1)	1/-		
5	Pattern Orientation					(2)	1/-		
6	Pattern Dimensions								
7	Relative Wind					(1)	8/1	•If deck status changes, need this.	
8	Signal Delta/Charlie					(1)	2/-		
9	Range					(1)	2/-		
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	(2B)					9/0		
13	Approach Slope Tracking Error			(3B)			8/1	•Need vertical velocity indication at 400'.	
14	Range Milestone					(1)	9/0		
15	Obstacle Clearance					(1)	2/-		
16	Relative Altitude					(1)	2/-	•May be included in flt. instr. warning. With or without load.	
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	9/0	•If deck status changes, need this.	
21	Ship Motion								
22	Wave Off					(1)	9/0		
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error		(2B)				7/2	•Should be proportional to proximity. IAW Grils, A/S is very	
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)			9/0	critical in close to transition to hover prior to landing.	
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data					(1)	1/-		
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-4-4A. USN H-46 Survey of Pilot Information Requirements - Operating from Auxiliaries, Segment 4A - Final Initial Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Change in Error Rate-Of-Change

No. Of Pilots: 8

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE		PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity									
2	Inbound Heading									
3	Base Recovery Course					(1)	8/0			
4	Ship Course Ambiguity									
5	Pattern Orientation									
6	Pattern Dimensions									
7	Relative Wind					(1)	7/1			
8	Signal Delta/Charlie					(2)	2/-			
9	Range									
10	Range Rate									
11	Time-To-Turn Milestone									
12	Lateral Tracking Error	2B					8/0			
13	Approach Slope Tracking Error			3C			8/0			
14	Range Milestone					(2)	8/0			
15	Obstacle Clearance					△	2/-			
16	Relative Altitude					2B △	2/-	(1.)		
17	Longitudinal Hover Position									
18	Lateral Hover Position									
19	Hover Azimuth Error									
20	Deck Status					(1)	7/1		*Important at this point.	(1.) 1, Level 1 Instructive 1, Level 2B Instructive
21	Ship Motion					△	1/-			(2.) Except for 7/1 Speed/Long'l.
22	Wave Off					(3)	8/0			(3.) 1, Level #1 1, Level #2
23	Horizontal Reference	1C	1C				8/0			
24	Hover Height									
25	Closure Rate Error		1B				5/3		*Critical on final approach to ship. Need to know early. Same as 4A.	
26	Aircraft Flight Instruments	1C	1B	1C			8/0	(2.)	*Need as much specific here as possible.	
	Special Info. Req'd. Cat.									
27	Density Altitude									
28	VERTREP Load Data					△	2/-	(3.)		
29	Aircraft Separation									
30	HIFR Status									
31	Skew/Tension Indications									
32	Sled Status									

Figure 6-4-4B. USN H-46 Survey of Pilot Information Requirements - Operating from Auxiliaries, Segment 4B - Final Close-In Approach

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Change in Error Rate-Of-Change

No. Of Pilots: 9

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	(3B)	(3B)	(3B)	(3B)		9/0 (1.)		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	(2C)					9/0		
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	(3B)	(3B)	(3B)			9/0		
16	Relative Altitude			(3C)			7/2	*How fast must you initiate correction? Acceleration in alt. very	
17	Longitudinal Hover Position		(2D)				9/0	critical here.	
18	Lateral Hover Position	(2D)					9/0		
19	Hover Azimuth Error				(1B)		6/3	*IRT VERTREP dash line requires little deviation in azimuth	
20	Deck Status					(1)	9/0	during hover. Landing too small or staged deck.	
21	Ship Motion	(2C)	(2C)	(2C)			9/0		
22	Wave Off					(3)	6/3		
23	Horizontal Reference	(1B)	(1B)	(1B)			9/0		
24	Hover Height			(1C)			9/0		
25	Closure Rate Error		(2B)				7/2	*Is closure rate accelerated?	
26	Aircraft Flight Instruments	(2B)	(1A)	(2B)			9/0 (2.)	*Longitudinal just as important as lateral & vertical. Speed in	
	Special Info. Req'd. Cat.							close & transitions - VSI is still important part in hover & need	
27	Density Altitude							vertical velocity information. I use VSI constantly!	
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

(1.) Except for 8/1 Azimuth

(2.) Except for 8/1 Speed/Long'l. and 7/2 Vertical

Figure 6-4-5. USN H-46 Survey of Pilot Information Requirements - Operating from Auxiliaries, Segment 5 - Hover

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 9

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instruitive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	3D	3B	3B	3B		9/0		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	3B	3B	3B	3B		9/0 (1.)		(1.) Except for 8/1 Azimuth
16	Relative Altitude								(2.) Except for 7/2 Speed/Long'l.
17	Longitudinal Hover Position		3D				9/0		
18	Lateral Hover Position	3D					9/0		
19	Hover Azimuth Error				1B		7/2	*Same reasoning on Seg 5 Hover Azimuth.	
20	Deck Status								
21	Ship Motion	2D	2D	2D			8/1 (2.)		
22	Wave Off								
23	Horizontal Reference	1B	1B	1B			9/0		
24	Hover Height			1D			9/0		
25	Closure Rate Error								
26	Aircraft Flight Instruments								
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-4-6. USN H-46 Survey of Pilot Information Requirements - Operating from Auxiliaries, Segment 6 - Vertical Landing

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 7

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					(1)	4/3	•Becomes critical on long flights.	
2	Inbound Heading	(2)B					7/0		
3	Base Recovery Course					(1)	7/0		
4	Ship Course Ambiguity					(1)	7/0		
5	Pattern Orientation					(1)	5/2	•Basic to relative wind.	
6	Pattern Dimensions					(1)	7/0		
7	Relative Wind					(2)	6/1	•Becomes important when load limits air speed. Necessary for	
8	Signal Delta/Charlie					(2)	5/2	mission planning. Time required to satisfactorily act. Load	
9	Range					(1)	7/0	related consideration. CRS alteration. May require determin-	
10	Range Rate					(1)	7/0	ation of loiter time vs. task. Depends on fuel state at start of	
11	Time-To-Turn Milestone							approach.	
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude								(1.) Except for 4/3 Lateral
17	Longitudinal Hover Position								" 5/2 Vertical
18	Lateral Hover Position								(2.) 4, Level #1
19	Hover Azimuth Error								1, Level #2
20	Deck Status					(1)	7/0		
21	Ship Motion					△1	2/-		
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	(1)C	(1)B	(1)C			7/0 (1.)		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data					△1	5/- (2.)	•Need to know for mission. Load weight limitations.	
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-5-1. USN H-46 Survey of Pilot Information Requirements - Operating from Combatants, Segment 1 - Homing

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: _____

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								The VERTREP interface is not considered sufficiently
4	Ship Course Ambiguity								different from other H-46 orientation segments.
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind								
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status								
21	Ship Motion								
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments								
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-5-2. USN H-46 Survey of Pilot Information Requirements - Operating from Combatants, Segment 2 - Orientation

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 6

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					△1	1/-		
2	Inbound Heading					△1	2/-	-Required to determine pattern to fly.	
3	Base Recovery Course					○1	6/0	-Required for pattern orientation.	
4	Ship Course Ambiguity								
5	Pattern Orientation					○1	5/1	-Plan pattern.	
6	Pattern Dimensions					○1	6/0		
7	Relative Wind					□2	3/3	-Plan Pattern. May require pattern adjustment. May determine	
8	Signal Delta/Charlie					○1	5/1	VERTREP final approach parameters.	
9	Range					○1	6/0		
10	Range Rate					○1	6/0		
11	Time-To-Turn Milestone					○1	6/0	-May re required when adjusting pattern.	
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance					△1	3/-	-External load increases clearance required.	
16	Relative Altitude					△1	1/-		
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					○1	6/0		
21	Ship Motion								
22	Wave Off					△1	1/-		
23	Horizontal Reference								
24	Hover Height					△1	1/-		
25	Closure Rate Error					△1	1/-		
26	Aircraft Flight Instruments	○1C	○1B	○1C			6/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data					△1	1/-		
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-5-3. USN H-46 Survey of Pilot Information Requirements Operating from Combatants, Segment 3 - Initial Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 7

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading					△1	2/-		
3	Base Recovery Course					△1	1/-		
4	Ship Course Ambiguity					△1	1/-		
5	Pattern Orientation					△3	1/-		
6	Pattern Dimensions								
7	Relative Wind					○1	4/3	*Determines type of approach or adjustment.	
8	Signal Delta/Charlie					△2	2/-		
9	Range					△1	1/-		
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	○2B					7/0		
13	Approach Slope Tracking Error			○3B			7/0		
14	Range Milestone					○1	7/0		
15	Obstacle Clearance					△1	2/-		
16	Relative Altitude					△1	2/-	*With or without load.	
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					○1	7/0		
21	Ship Motion								
22	Wave Off					○1	6/1	*Need to know early if requirement exists.	
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error		□1B				5/2	*External load is additional parameter. Need to know early if requirement exists.	
26	Aircraft Flight Instruments	○1C	○1B	○1C			7/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data					△1	2/-	*Weight for load to be picked up important.	
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-5-4A. USN H-46 Survey of Pilot Information Requirements - Operating from Combatants, Segment 4A - Final Initial Approach

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 7

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					△1	1/-		
2	Inbound Heading								
3	Base Recovery Course					○1	7/0		
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind					○1	5/2	*Pattern or approach may need adjustment.	
8	Signal Delta/Charlie					△2	2/-		
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	○2B					7/0		
13	Approach Slope Tracking Error			○3C			7/0		
14	Range Milestone					○2	7/0		
15	Obstacle Clearance					△3	3/-	*External load an additional factor.	
16	Relative Altitude					△1	4/-	*VERTREP app. w/w/o load imposes another variable.	(1.) 3, Level #3 3, Level #2 1, Level #1
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					○3	7/0 (1.)	*Would not want to stand off at night with a load, must know early. Deck status effects aircraft approach w/load.	
21	Ship Motion					△1	1/-		
22	Wave Off					○3	7/0		
23	Horizontal Reference	○1C	○1C				7/0		
24	Hover Height								
25	Closure Rate Error		○2B				5/2	*VERTREP load additional factor. Rate of closure in VERTREP situation parameter.	
26	Aircraft Flight Instruments	○1C	○1B	○1C			7/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data					△2	2/-	*Weight for load to be picked up is important.	
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-5-4B. USN H-46 Survey of Pilot Information Requirements - Operating from Combatants, Segment 4B - Final Close-In Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 7

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	3B	3B	3B	3B		6/1	*Important in picking up load.	
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	2C					6/1		
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	3B	3B	3B			6/1	*VERTREP load additional consideration.	
16	Relative Altitude			3C			7/0		
17	Longitudinal Hover Position		2D				6/1	*Depends on location of load.	
18	Lateral Hover Position	2D					6/1	*For pick up/drop.	
19	Hover Azimuth Error				1B		5/2		
20	Deck Status					1	2/5		
21	Ship Motion	2C	2C	2C			7/0		
22	Wave Off					3	4/3		
23	Horizontal Reference	1B	1B	1B			7/0		
24	Hover Height			1C			3/4		
25	Closure Rate Error		2B				4/3	*External load a factor. Closure rate paramount in VERTREP approach.	
26	Aircraft Flight Instruments	2B	1A	2B			7/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data					2	3/4	*. Ability to pick up load. Weight of load to be picked up essential.	
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-5-5. USN H-46 Survey of Pilot Information Requirements - Operating from Combatants, Segment 5 - Hover

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 9

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	3B	3D	3B	3B		9/0 (1.)	•Wind across deck important w/external load. Important to pick up load.	
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone							19.• Tandem rotor consideration. Picking up loads near T line.	
12	Lateral Tracking Error							Must be directly over dash line on some drop zones.	
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	3B	3B	3B	3B		9/0 (2.)	•Tandem rotor & external load consideration. Depends on load	
16	Relative Altitude							location-drop location. Tandem rotor & external load con-	(1.) Except for B/- Azimuth
17	Longitudinal Hover Position		3D				5/4	sideration.	(2.) Except for 7/2 Azimuth
18	Lateral Hover Position	3D					6/3	•Tandem rotor & external load consideration. Depends on load	(3.) 3, Level #3C Azimuth
19	Hover Azimuth Error				3C		9/0 (3.)	location-drop location. Tandem rotor & external load con-	3, Level #1B Azimuth
20	Deck Status					△2	2/-	sideration.	1, Level #2B Azimuth
21	Ship Motion	2D	2D	2D			6/3	•Motion will limit how low hover can be for hook up.	1, Level #3D Azimuth
22	Wave Off					△3	2/-		1, Level #2D Azimuth
23	Horizontal Reference	1B	1B	1B			7/2		(4.) 3, Level #2D
24	Hover Height			2D			9/0 (4.)	•VERTREP load height above deck critical and we need accelera-	2, Level #1D
25	Closure Rate Error							tion and cues during approach. Flight instruments are moni-	3, Level #3D
26	Aircraft Flight Instruments							tored by pilot not flying.	1, Level #3
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data					△2	2/-	•Important during load pick up. Instructive info required - type	
29	Aircraft Separation							load, weight, size, shape & density.	
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-5-6. USN H-46 Survey of Pilot Information Requirements - Operating from Combatants, Segment 6 - Vertical Landing

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 3

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					(1)	3/0		
2	Inbound Heading	(1)X					3/0		
3	Base Recovery Course					(1)	3/0		
4	Ship Course Ambiguity					(1)	3/0		
5	Pattern Orientation					(1)	3/0		
6	Pattern Dimensions					(1)	3/0		
7	Relative Wind					(1)	3/0		
8	Signal Delta/Charlie					(1)	3/0		
9	Range					(1)	3/0		
10	Range Rate					(1)	3/0		
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	3/0		
21	Ship Motion								
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	(1)C	(1)C	(1)C			3/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-6-1. USN H-53 Survey of Pilot Information Requirements - Operating from LPD's, Segment 1 - Homing

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 3

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course					(1)	3/0		
4	Ship Course Ambiguity					(1)	3/0		
5	Pattern Orientation					(1)	3/0		
6	Pattern Dimensions					(1)	3/0		
7	Relative Wind					(1)	3/0		
8	Signal Delta/Charlie					(1)	3/0		
9	Range					(1)	3/0		
10	Range Rate					(1)	3/0		
11	Time-To-Turn Milestone					(1)	3/0		
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	3/0		
21	Ship Motion								
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	(C)	(B)	(C)			3/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-6-2. USN H-53 Survey of Pilot Information Requirements - Operating from LPD's, Segment 2 - Orientation

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 3

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course					(1)	3/0		
4	Ship Course Ambiguity								
5	Pattern Orientation					(1)	3/0		
6	Pattern Dimensions					(1)	3/0		
7	Relative Wind					(1)	3/0		
8	Signal Delta/Charlie					(1)	3/0		
9	Range					(1)	3/0		
10	Range Rate					(1)	3/0		
11	Time-To-Turn Milestone					(1)	3/0		
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	3/0		
21	Ship Motion								
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)			3/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-6-3. USN H-53 Survey of Pilot Information Requirements - Operating from LPD's, Segment 3 - Initial Approach

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 3

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind					(1)	3/0		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	(2B)					3/0		
13	Approach Slope Tracking Error			(3B)			3/0		
14	Range Milestone					(1)	3/0		
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	3/0		
21	Ship Motion								
22	Wave Off					(1)	3/0		
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error		(1B)				3/0		
26	Aircraft Flight Instruments	(1C)	(1C)	(1C)			3/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-6-4A. USN H-53 Survey of Pilot Information Requirements - Operating from LPD's, Segment 4A - Final Initial Approach

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 3

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course					(1)	3/0		
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind					(1)	3/0		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	(2B)					3/0	*Might need rate info. as near ship.	
13	Approach Slope Tracking Error			(3C)			3/0		
14	Range Milestone					(2)	3/0		
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	3/0		
21	Ship Motion								
22	Wave Off					(3)	3/0		
23	Horizontal Reference	(1C)	(1C)				3/0		
24	Hover Height								
25	Closure Rate Error		(2B)				2/1	*Critical nose altitude. A/S of H-53 required definite warning	
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)			3/0	of closure rate. H-53 weight makes speed change critical.	
	Special Info. Req'd. Cat.							(2B) Speed critical, closure rate must be on.	
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-6-4B. USN H-53 Survey of Pilot Information Requirements - Operating from LPD's, Segment 4B - Final Close-In Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 3

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Longit.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	3B	3B	3B	3B		3/0		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	2D					3/0		
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	3B	3B	3B			3/0		
16	Relative Altitude			3C			3/0		
17	Longitudinal Hover Position		2D				3/0		
18	Lateral Hover Position	2D					3/0		
19	Hover Azimuth Error				1B		3/0		
20	Deck Status					(1)	3/0		
21	Ship Motion	2D	2D	3D			3/0	• Could be "3" for some helos vs. ships.	
22	Wave Off					(3)	3/0		
23	Horizontal Reference	1B	1B	1B			3/0		
24	Hover Height			3D			2/1	• 3D Pilot's perception of rate and change of rate necessary all the way down.	
25	Closure Rate Error		3D				2/1		
26	Aircraft Flight Instruments	2B	1A	2B			3/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-6-5. USN H-53 Survey of Pilot Information Requirements - Operating from LPD's, Segment 5 - Hover

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 3

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind							*Info no longer needed if able to hold hover. Once actual landing	
8	Signal Delta/Charlie							begins, relative wind no longer necessary.	
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	3D	3D	3D	3D		3/0		
16	Relative Altitude								
17	Longitudinal Hover Position		3D				3/0		
18	Lateral Hover Position	3D					3/0		
19	Hover Azimuth Error				3D		2/1	*H-53 nose altitude is critical. Due to H-53 nose altitude (5° -	
20	Deck Status							7° nose high).	
21	Ship Motion	2D	2D	2D			3/0		
22	Wave Off								
23	Horizontal Reference	1D	1D	1D			3/0		
24	Hover Height			3D			1/2	*3D, Pilot perception all the way down.	
25	Closure Rate Error								
26	Aircraft Flight Instruments								
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-6-6. USN H-53 Survey of Pilot Information Requirements - Operating from LPD's, Segment 6 - Vertical Landing

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 1

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	3B					1/0		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	3C					1/0		
16	Relative Altitude								
17	Longitudinal Hover Position		3C				1/0		
18	Lateral Hover Position	1B					1/0		
19	Hover Azimuth Error				1B		1/0		
20	Deck Status					1	1/0		
21	Ship Motion								
22	Wave Off								
23	Horizontal Reference	1B	1B	1C			1/0		
24	Hover Height			1C			1/0		
25	Closure Rate Error								
26	Aircraft Flight Instruments					1	1/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications	1B		1B			1/0		
32	Sled Status								

Figure 6-7-1. USN H-53 Survey of Pilot Information Requirements - MK 105 SLED, Hook-Up Maneuver A

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 1

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	2B					1/0		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	3C					1/0		
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position			3C			1/0		
19	Hover Azimuth Error				1B		1/0		
20	Deck Status								
21	Ship Motion								
22	Wave Off								
23	Horizontal Reference	1B	1B	1B			1/0		
24	Hover Height			3C			1/0		
25	Closure Rate Error								
26	Aircraft Flight Instruments					1	1/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications	2B		2B			1/0		
32	Sled Status								

Figure 6-7-2. USN H-53 Survey of Pilot Information Requirements - MK 105 SLED, Hook-Up Maneuver B

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 3

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					(1)	3/0		
2	Inbound Heading	(1B)					3/0		
3	Base Recovery Course					(1)	3/0		
4	Ship Course Ambiguity					(1)	3/0		
5	Pattern Orientation	(1B)					3/0		
6	Pattern Dimensions					(1)	3/0		
7	Relative Wind	(1B)					3/0		
8	Signal Delta/Charlie					(1)	3/0		
9	Range					(1)	3/0		
10	Range Rate					(1)	3/0		
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	3/0		
21	Ship Motion								
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	(1C)	(1C)	(1C)		(1)	3/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-8-1. USN H-53 Survey of Pilot Information Requirements - Operating from LPD's and Towing MK 105 SLED, Segment 1 - Homing

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

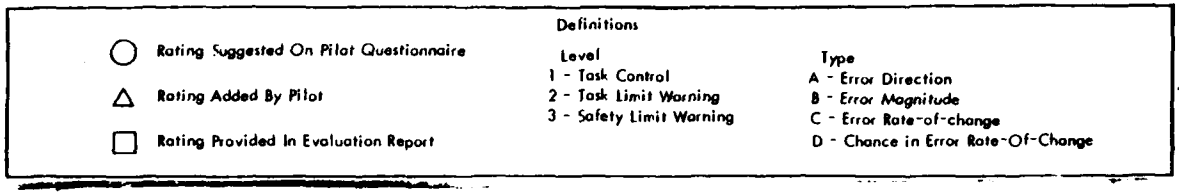
Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 3

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course					(1)	3/0		
4	Ship Course Ambiguity					(1)	3/0		
5	Pattern Orientation	(2) ?							
6	Pattern Dimensions					(1)	3/0		
7	Relative Wind	(2) ?							
8	Signal Delta/Charlie					(1)	3/0		
9	Range					(1)	3/0		
10	Range Rate					(1)	3/0		
11	Time-To-Turn Milestone					(1)	3/0		
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	3/0		
21	Ship Motion								
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)			3/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications	(1C)	(1C)	(1C)			3/0		
32	Sled Status								

Figure 6-8-2. USN H-53 Survey of Pilot Information Requirements - Operating from LPD's and Towing MK 105 SLED, Segment 2 - Orientation



No. Of Pilots: 3

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind					(1)	3/0		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	(2B)					3/0		
13	Approach Slope Tracking Error					(1)	3/0		
14	Range Milestone					(2)	3/0		
15	Obstacle Clearance								
16	Relative Altitude					(3)	3/0		
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	3/0		
21	Ship Motion								
22	Wave Off					(3)	3/0		
23	Horizontal Reference	(1C)	(1C)				3/0		
24	Hover Height								
25	Closure Rate Error		(1B)				3/0		
26	Aircraft Flight Instruments	(1C)	(1C)	(1C)			3/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications	(3B)	(3B)				3/0		
32	Sled Status								

Figure 6-8-3. USN H-53 Survey of Pilot Information Requirements - Operating from LPD's and Towing MK 105 SLED, Segment 3 - Initial Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 3

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	3B	3B	3B	3B		3/0		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	2C					3/0		
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	3B	3B	3B			3/0		
16	Relative Altitude					3C	3/0		
17	Longitudinal Hover Position		2D				3/0		
18	Lateral Hover Position	2D					3/0		
19	Hover Azimuth Error				2B		3/0		
20	Deck Status					1	3/0		
21	Ship Motion					3	3/0		
22	Wave Off	2C	2C	2C			3/0		
23	Horizontal Reference	1B	1B	1B			3/0		
24	Hover Height			1C			3/0		
25	Closure Rate Error		2B				3/0		
26	Aircraft Flight Instruments	2B	2B	2B			3/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications	3B	3B				3/0		
32	Sled Status								

Figure 6-8-4. USN H-53 Survey of Pilot Information Requirements - Operating from LPD's and Towing MK 105 SLED, Segment 4 - Hover

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 3

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind					(1)	3/0		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	(3B)	(3B)	(3B)	(3B)		3/0		
16	Relative Altitude								
17	Longitudinal Hover Position		(3D)				3/0		
18	Lateral Hover Position	(3D)					3/0		
19	Hover Azimuth Error				(1B)		3/0		
20	Deck Status								
21	Ship Motion	(2D)	(2D)	(2D)			3/0		
22	Wave Off								
23	Horizontal Reference	(1B)	(1B)	(1B)			3/0		
24	Hover Height			(1D)			3/0		
25	Closure Rate Error								
26	Aircraft Flight Instruments								
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-8-5. USN H-53 Survey of Pilot Information Requirements - Operating from LPD's and Towing MK 105 SLED, Segment 5 - Vertical Landing

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 1

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Longi'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					○	1/0		
2	Inbound Heading	○1B					1/0		
3	Base Recovery Course					○	1/0		
4	Ship Course Ambiguity					○	1/0		
5	Pattern Orientation	○1B					1/0		
6	Pattern Dimensions					○	1/0		
7	Relative Wind	○1B					1/0		
8	Signal Delta/Charlie					○	1/0		
9	Range					○	1/0		
10	Range Rate					○	1/0		
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude					○3C	1/0		
17	Longitudinal Hover Position								
18,	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					○1	1/0		
21	Ship Motion								
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	○1C	○1C	○1C		○1	1/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications	○1C	○1C	○1C			1/0		
32	Sled Status								

Figure 6-9-1. USN H-53 Survey of Pilot Information Requirements - MK 105 SLED Recovery, Segment 1 - Homing

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 1

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course					(1)	1/0		
4	Ship Course Ambiguity					(1)	1/0		
5	Pattern Orientation	1B							
6	Pattern Dimensions					(1)	1/0		
7	Relative Wind	1B					1/0		
8	Signal Delta/Charlie					(1)	1/0		
9	Range					(1)	1/0		
10	Range Rate					(1)	1/0		
11	Time-To-Turn Milestone					(1)	1/0		
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude					3C	1/0		
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	1/0		
21	Ship Motion								
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error						1/0		
26	Aircraft Flight Instruments	1C	1B	1C					
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications	1C	1C	1C			1/0		
32	Sled Status								

Figure 6-9-2. USN H-53 Survey of Pilot Information Requirements - MK 105 SLED Recovery, Segment 2 - Orientation

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 1

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind					(1)	1/0		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	2B					1/0		
13	Approach Slope Tracking Error					(1)	1/0	*Approach will be flat @ 100'.	
14	Range Milestone					(2)	1/0		
15	Obstacle Clearance								
16	Relative Altitude					(3)	1/0		
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	1/0		
21	Ship Motion								
22	Wave Off					(3)	1/0		
23	Horizontal Reference	1C	1C				1/0		
24	Hover Height								
25	Closure Rate Error		1B				1/0		
26	Aircraft Flight Instruments	1C	1C	1C			1/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications	3B	3B				1/0		
32	Sled Status					(1)	1/0	*Foils boom up, turbine shut down.	

Figure 6-9-3. USN H-53 Survey of Pilot Information Requirements - MK 105 SLED Recovery, Segment 3 - Initial Approach

Definitions

- ○ Rating Suggested On Pilot Questionnaire
- △ Rating Added By Pilot
- □ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 1

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	3B	3B	3C	3B		1/0		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	2C					1/0		
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	3B	3B	3C			1/0		
16	Relative Altitude			3C			1/0		
17	Longitudinal Hover Position		2D				1/0		
18	Lateral Hover Position	2D					1/0		
19	Hover Azimuth Error				2B		1/0		
20	Deck Status					1	1/0		
21	Ship Motion	2C	2C	2C			1/0		
22	Wave Off					3	1/0		
23	Horizontal Reference	1D	1D	1C			1/0		
24	Hover Height			1C			1/0		
25	Closure Rate Error		2C				1/0		
26	Aircraft Flight Instruments	2B	2B	2B			1/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications	3B	3B				1/0		
32	Sled Status								

Figure 6-9-4. USN H-53 Survey of Pilot Information Requirements - MK 105 SLED Recovery, Segment 4 - Final Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 1

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind					(1)	1/0		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	(3)	(3)	(3)	(3)		1/0		
16	Relative Altitude								
17	Longitudinal Hover Position		(3)				1/0		
18	Lateral Hover Position	(3)					1/0		
19	Hover Azimuth Error				(1B)		1/0		
20	Deck Status								
21	Ship Motion	(2)	(2)	(2)			1/0		
22	Wave Off								
23	Horizontal Reference	(1B)	(1B)	(1B)			1/0		
24	Hover Height			(1D)			1/0		
25	Closure Rate Error								
26	Aircraft Flight Instruments								
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-9-5. USN H-53 Survey of Pilot Information Requirements - MK 105 SLED Recovery, Segment 5 - Hover

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 28

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					1	25/3	•Critical if operation at limits of range and EMCON.	
2	Inbound Heading	1B					27/1		
3	Base Recovery Course					1	28/0	•Location	
4	Ship Course Ambiguity					1	28/0		
5	Pattern Orientation					1	28/0		
6	Pattern Dimensions					1	28/0		
7	Relative Wind					1	27/1		
8	Signal Delta/Charlie					1	28/0		
9	Range					1	27/1		
10	Range Rate					1	28/0		
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					1	28/0		
21	Ship Motion					△1	5/-	•In case a larger ship or alternate is available. Nice to know for planning.	
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error	1C	1D	1C			28/0		
26	Aircraft Flight Instruments								
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-10-1. MC UH-1/AH-1 Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 1 - Homing

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 28

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					△1	1/-		
2	Inbound Heading	△1A					1/-		
3	Base Recovery Course					○1	24/4	*Determines flight pattern, turn to down wind, etc.	
4	Ship Course Ambiguity					○1	28/0		
5	Pattern Orientation					○1	25/3	*Wrong patterns cause wave-off & confusion.	
6	Pattern Dimensions					○1	27/1	*Safe areas - clear.	
7	Relative Wind					○1	28/0		
8	Signal Delta/Charlie					○1	26/2	*Fuel considerations will increase this.	
9	Range					○1	26/2	*Obstacle free.	
10	Range Rate					○1	27/1		
11	Time-To-Turn Milestone					○1	27/1		
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					○1	28/0		
21	Ship Motion					△1	2/-	*Helos plan final.	
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	○1C	○1D	○1C			27/1		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-10-2. MC UH-1/AH-1 Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 2 - Orientation

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 28

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					△	3/- (1.)		
2	Inbound Heading					△	2/-		
3	Base Recovery Course					○	25/3	•Determines this particular portion (i.e., downwind)	
4	Ship Course Ambiguity					△	2/-		
5	Pattern Orientation					○	26/2		
6	Pattern Dimensions					○	27/1		
7	Relative Wind					○	28/0		
8	Signal Delta/Charlie					○	27/1	•Need for individual aircraft to know signal/continuous info.	
9	Range					○	26/2	•Obstacle clearance.	
10	Range Rate					○	28/0		
11	Time-To-Turn Milestone					○	26/2	•Rate of turn/angle of bank must be small, i.e., less than or equal to SRT/vertical mode.	
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								(1.) 2, Level #1 Instructive 1, Level #2 Instructive
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					○	28/0		
21	Ship Motion					△	2/-		
22	Wave Off					△	2/-		
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	1C	1B	1C			28/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Slew/Tension Indications								
32	Sled Status								

Figure 6-10-3. MC UH-1/AH-1 Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 3 - Initial Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 28

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					△1	2/- (1.)		
2	Inbound Heading					△1	3/-		
3	Base Recovery Course					△1	3/-		
4	Ship Course Ambiguity								
5	Pattern Orientation					△1	1/-		
6	Pattern Dimensions					△1	2/-		
7	Relative Wind					○1	27/1	*Wind blowing at tail if aircraft could cause a wave-off or missed approaches. Nice to know - could save a wave-off.	
8	Signal Delta/Charlie					△1	5/-		
9	Range							8.*Continues	
10	Range Rate					△1	2/-	9.*For indication of possible wave-off.	
11	Time-To-Turn Milestone					△1	4/-		
12	Lateral Tracking Error	2B					28/0		(1.) 1, Level #1 1, Level #2
13	Approach Slope Tracking Error			3B			27/1		(2.) Except for 27/1 Vertical
14	Range Milestone					○1	28/0		
15	Obstacle Clearance					△1	2/-	*Sometimes ships operate in trail of the LPH.	
16	Relative Altitude					△1	2/-		
17	Longitudinal Hover Position								
18	Lateral Hover Position	•							
19	Hover Azimuth Error								
20	Deck Status					○1	28/0		
21	Ship Motion					△1	1/-		
22	Wave Off					○1	28/0		
23	Horizontal Reference					△1	5/-		
24	Hover Height								
25	Closure Rate Error		1B				28/0	*Closure rate may not be available.	
26	Aircraft Flight Instruments	1C	1B	1C			28/0 (2.)	-90° position is critical and speed has to be controlled.	
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-10-4A. MC UH-1/AH-1 Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 4A - Final Initial Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 28

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course					①△	28/0		
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions							7.*As approach progresses, relative wind becomes critical with	
7	Relative Wind					①△	27/1	respect to closure.	
8	Signal Delta/Charlie					△△	4/-	*Continuous.	
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone					△	1/-		
12	Lateral Tracking Error	2B					28/0		(1.) 3, Level ≠2 Instructive
13	Approach Slope Tracking Error			2C			28/0		(2.) 1, Level ≠1
14	Range Milestone					②△	27/1		(3.) 2, Level ≠1 Instructive
15	Obstacle Clearance					△	6/- (1.)		1, Level ≠28 Vertical
16	Relative Altitude			△			2/- (2.)	*Close proximity, wave-offs are made for being too low.	
17	Longitudinal Hover Position					△△	3/-		
18	Lateral Hover Position					△△	3/-		
19	Hover Azimuth Error								
20	Deck Status					①△	25/3		
21	Ship Motion					△△	2/- (3.)		
22	Wave Off					③△	28/0		
23	Horizontal Reference	1C	1C				28/0		
24	Hover Height								
25	Closure Rate Error		1D				23/5		
26	Aircraft Flight Instruments	1C	1D	1C			28/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-10-4B. MC UH-1/AH-1 Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 4B - Final Close-In Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 28

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE		PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity									
2	Inbound Heading									
3	Base Recovery Course									
4	Ship Course Ambiguity									
5	Pattern Orientation									
6	Pattern Dimensions									
7	Relative Wind	3B	3B	3B	3B		27/1	(1.)	•Should have been considered before now.	
8	Signal Delta/Charlie								•Wave-off should be made at this point if the information is not available. Must improve at this stage. Roll rate too.	
9	Range									
10	Range Rate									
11	Time-To-Turn Milestone									
12	Lateral Tracking Error	2C					28/0			
13	Approach Slope Tracking Error									
14	Range Milestone									
15	Obstacle Clearance	3B	3B	3B			28/0			(1.) Except for 28/0 Vertical
16	Relative Altitude			3C			28/0			(2.) Except for 27/1 Speed/Long'l.
17	Longitudinal Hover Position		2D				28/0			
18	Lateral Hover Position	2D					28/0			
19	Hover Azimuth Error				1B		28/0			
20	Deck Status					(1)	21/7			
21	Ship Motion	2C	2C	2C						
22	Wave Off					(3)	28/0			
23	Horizontal Reference	1B	1B	1B			27/1		•Could be deck edge lights, floods, etc.	
24	Hover Height			1C			27/1		•In conjunction with ship motion.	
25	Closure Rate Error		2B				25/3		•Closure must be under control. Tremendously high closure rates	
26	Aircraft Flight Instruments	2B	1A	2B			28/0	(2.)	may ruin your day.	
	Special Info. Req'd. Cat.									
27	Density Altitude									
28	VERTREP Load Data									
29	Aircraft Separation									
30	HIFR Status									
31	Skew/Tension Indications									
32	Sled Status									

Figure 6-10-5. MC UH-1/AH-1 Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 5 - Hover

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 28

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	3B	3B	3B	3C		28/0		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								(1.) Except for 27/1 Lateral, and 25/3 Speed/Long'l.
15	Obstacle Clearance	3B	3B	3B	3C		28/0		
16	Relative Altitude								
17	Longitudinal Hover Position		3C				28/0		
18	Lateral Hover Position	3C					28/0		
19	Hover Azimuth Error				1B		25/3	•From hover to set down, all info has been used only visual ref	
20	Deck Status					△1	1/-	used to feel for ground.	
21	Ship Motion	2C	2C	2C			28/0 (1.)	•Tremendous impact on ability to land without damage.	
22	Wave Off					△3	1/-		
23	Horizontal Reference	1B	1B	1B			27/1	•Visual cues must be available.	
24	Hover Height			1C			26/2	•Ship motion - control of descent.	
25	Closure Rate Error								
26	Aircraft Flight Instruments								
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-10-6. MC UH-1/AH-1 Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 6 - Vertical Landing

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 19

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					○1	9/10	Critical. We need instruction & a visual slope indicator on the	
2	Inbound Heading	○1B					14/5	ship. Must know fuel or combat situation. Critical. Need to	
3	Base Recovery Course					○1	17/2	identify ship to follow heading. Primary consideration is the	
4	Ship Course Ambiguity					○1	17/2	correct ship selection.	
5	Pattern Orientation					○1	15/4	Occasionally. Several marshall points. Critical if you have	
6	Pattern Dimensions					○1	19/0	multiple flights.	
7	Relative Wind					○1	17/2	Nice to know.	
8	Signal Delta/Charlie					○1	19/0	Nice to know.	
9	Range					○2	16/3	Nice to know. Critical if low fuel state or multiple flights.	
10	Range Rate					○2	18/1	Critical due to fuel reqmts.	
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					○1	16/3	If fouled - estimate time delay. Foul deck? Don't need while	
21	Ship Motion	△1A		△1A		□N	1/-	homing. Like to know.	
22	Wave Off	△1A					1/-		
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	○1C	○1C	○1C			18/1	Nice to know.	
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation	△3C	△3C	△3C		□N	1/-	If multi-aircraft operations.	
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-11-1. MC H-46 Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 1 - Homing

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 19

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course					○1	12/7	•Critical to flight pattern if multiple flights. If cus must know.	
4	Ship Course Ambiguity					○1	18/1	If Cus must know. Critical for multiple flights. 2 vice 1 for	
5	Pattern Orientation					○1	14/5	more than one marshalling. 2 vice 1 for obstacle info. More	
6	Pattern Dimensions					○1	17/2	than 1 flight of aircraft. Determines flight pattern, turn to	
7	Relative Wind					○1	18/- (1.)	downwind, etc.	
8	Signal Delta/Charlie					○1	16/3	5.•Wrong patterns cause wave-offs & confusion.	
9	Range					○1	15/4	6.•Safe areas - clear.	
10	Range Rate					○1	19/0	7.•Need to know/adjust pattern, deck status.	
11	Time-To-Turn Milestone					○1	19/0	8.•Critical if multiple flights. Other aircraft in Delta. What is	
12	Lateral Tracking Error							recovery/separation of multiples/terrain clearance/critical	
13	Approach Slope Tracking Error							for fuel req. Obstacle info.	
14	Range Milestone							9.•Obstacle free.	
15	Obstacle Clearance							11.•2 vice 1 to prevent pattern over/up if more than 1 marshall	(1.) 1 Deletion
16	Relative Altitude							area.	2, Level #2B Speed/Long'l,
17	Longitudinal Hover Position								•1, Level #1A Lateral
18	Lateral Hover Position								(2.) Except for 17/2 Vertical
19	Hover Azimuth Error								
20	Deck Status					○1	13/6	•Est. time delay if fouled. Foul deck situation. If from 1 must know.	
21	Ship Motion					△1	1/-	•Helps plan final.	
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	○1C	○1B	○1C			18/1 (2.)	• Critical if multiple flights.	
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation	△3C	△3C	△3C		△3	1/-	• Multi-aircraft operation.	
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-11-2. MC H-46 Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 2 - Orientation

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 19

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course					(1)	15/4	•Again for plan. Need for race track pattern. Accessory for	
4	Ship Course Ambiguity							landing.	
5	Pattern Orientation					(1)	18/1		
6	Pattern Dimensions					(1)	19/0	•For planning. Obstacle.	
7	Relative Wind					(1)	14/5	•Require winds necessary for landing.	
8	Signal Delta/Charlie					(1)	15/4	9.•Only as to too close aboard. Fuel consideration.	
9	Range					(1)	19/0	Need to know for plan.	
10	Range Rate					(1)	18/1	•Closure rate. More critical in terms of inter aircraft.	
11	Time-To-Turn Milestone					(1)	19/0	•Becomes more important for flights of aircraft.	
12	Lateral Tracking Error								
13	Approach Slope Tracking Error					△2	3/- (1.)	•Downwind.	
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude								(1.) 2, Level 2
17	Longitudinal Hover Position								1, Level 3
18	Lateral Hover Position								1, Level 1
19	Hover Azimuth Error								(2.) Except for 17/2 Vertical
20	Deck Status					(1)	6/13	•Important to adjust flight pattern (i.e., reduce A/S, Foul deck,	
21	Ship Motion							If △ must know. Can you land?	
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)			19/0 (2.)		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications							•Multiple aircraft operations create significant increase info. req.	
32	Sled Status							& aircraft or flight separation becomes critical.	

Figure 6-11-3. MC H-46 Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 3 - Initial Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 19

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind					(1)	14/5	*Determines L of bank. Still important.	
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	2B					19/0		
13	Approach Slope Tracking Error			3B			17/2		
14	Range Milestone					(1)	18/1		(1.) Except for 16/4 Vertical
15	Obstacle Clearance								" " 17/2 Speed/Long'l.
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	11/8	*Important if multiple flights. What's the fuel status. Foul deck	
21	Ship Motion							situation. Can you land. Starting to get important.	
22	Wave Off					(1)	14/5	*Need to be firmed up now.	
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error		1B				13/6		
26	Aircraft Flight Instruments	1C	1B	1C			19/0 (1.)	*Need a definite low warning system, easy to fly into water.	
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-11-4A. MC H-46 Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 4A - Final Initial Approach

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 19

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course					(1)	19/0		
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind					(1)	16/3		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	2B					19/0		
13	Approach Slope Tracking Error			3C			18/1		(1.) Except for 15/4 Vertical
14	Range Milestone					(2)	18/1	*For prep. of wave-off.	" " 17/2 Speed/Long'l.
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	12/7	*Determines approx. speed. Can adjust if deck is about to clear.	
21	Ship Motion							Foul deck situation.	
22	Wave Off					(3)	19/0	*Have to know.	
23	Horizontal Reference	1C	1C				18/1	*Not that critical. I usually fly a specific altitude on my rad	
24	Hover Height							alt. to within 200' of the LPH.	
25	Closure Rate Error		1B				10/9	*Very important.	
26	Aircraft Flight Instruments	1C	1B	1C			18/1 (1.)		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-11-4B. MC H-46 Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 4B - Final Close-In Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 19

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE		PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity									
2	Inbound Heading									
3	ase Recovery Course									
4	Ship Course Ambiguity									
5	Pattern Orientation									
6	Pattern Dimensions									
7	Relative Wind	3B	3B	3B	3B		17/2		*Important that you receive it by 4A - once you get this info, you adjust your A/S and approach accordingly. Critical for closure rate - hover/yes.	
8	Signal Delta/Charlie									
9	Range									
10	Range Rate									
11	Time-To-Turn Milestone									
12	Lateral Tracking Error	2C					18/1			
13	Approach Slope Tracking Error									
14	Range Milestone									
15	Obstacle Clearance	3B	3B	3B			19/0	(1.)		(1.) Except for 18/1 Speed/Long'l.
16	Relative Altitude			3C			19/0			(2.) Except for 18/1 Vertical and Speed/Long'l.
17	Longitudinal Hover Position		2D				18/1			
18	Lateral Hover Position	2D					17/2		*Drop lights on side would be helpful.	
19	Hover Azimuth Error				1B		16/3		*Most important at this stage.	
20	Deck Status					(1)	10/9		*Relation to other deck aircraft. Depends on other aircraft in vicinity as well as red & green deck.	
21	Ship Motion	2C	2C	2C			19/0			
22	Wave Off					(3)	19/0		*LSE signal. Already know.	
23	Horizontal Reference	1B	1B	1B			18/1		*Neither need nor have.	
24	Hover Height			1C			11/8		*Critical.	
25	Closure Rate Error		2B				9/10		*Extremely important; must be able to recognize close.	
26	Aircraft Flight Instruments	2B	1A	2B			19/0	(2.)		
	Special Info. Req'd. Cat.									
27	Density Altitude									
28	VERTREP Load Data									
29	Aircraft Separation									
30	HIFR Status									
31	Skew/Tension Indications									
32	Sled Status									

Figure 6-11-5. MC H-46 Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 5 - Hover

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 18

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	3B	3B	3B	3B		16/2	• See previous pages comment on relative wind.	
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	3B	3B	3B	3B		18/0		(1.) But not validated in pilot questionnaire.
16	Relative Altitude							• Relative to hover.	
17	Longitudinal Hover Position		3D				18/0	• Relative to hover.	(2.) Except for 13/5 Speed/Long'l.
18	Lateral Hover Position	3D					18/0		
19	Hover Azimuth Error				1B		12/6		
20	Deck Status					1	(1.)		
21	Ship Motion	2D	2D	2D			15/3 (2.)	• Sudden pitching or rolling can insure a safe landing, Rel. to hover.	
22	Wave Off					3	3/-	• Still might have to wave-off for wheel going in catwalk, Wind across deck. Foul deck.	
23	Horizontal Reference	1B	1B	1B			17/1		
24	Hover Height			1D			12/6	23. • Disagree, not enough time to be playing with this; so many things happening.	
25	Closure Rate Error								
26	Aircraft Flight Instruments							24. • Important. Too high or low is critical.	
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-11-6. MC H-46 Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 6 - Vertical Landing

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 12

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					(1)	4/8	•Depends on number of ships in task force. Identity becomes more	
2	Inbound Heading	(1B)					10/2	critical when more than one ship is present.	
3	Base Recovery Course					(1)	10/2	2, •Control in heading in hover, not a factor till seg. 2.	
4	Ship Course Ambiguity					(1)	9/3		
5	Pattern Orientation					(1)	11/1	•Becomes important with multiple aircrafts & patterns.	
6	Pattern Dimensions					(1)	11/1		
7	Relative Wind					(1)	12/0		
8	Signal Delta/Charlie					(1)	10/2	•Due to multiple flights of divisions. Nice to know.	
9	Range					(1)	12/0	•With divisions of aircraft greater concern for time to landing.	
10	Range Rate					(1)	12/0		
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	10/2	•Don't head while homing.	
21	Ship Motion								
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	(1C)	(1C)	(1C)			12/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-12-1. MC H-53 Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 1 - Homing

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Change in Error Rate-Of-Change

No. Of Pilots: 12

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course					○	9/3	*BRC determines marshall orientation.	
4	Ship Course Ambiguity					○	10/2		
5	Pattern Orientation					○	11/1		
6	Pattern Dimensions					○	12/0		
7	Relative Wind					○	11/1		
8	Signal Delta/Charlie					○	9/3	*Numbers of aircraft. In single plane operations possible, but in	
9	Range					○	12/0	multiple aircraft recovery (several aircraft recovering at same	
10	Range Rate					○	12/0	time not necessarily information). This becomes very important	
11	Time-To-Turn Milestone					○	12/0	to avoid mid-airs.	
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								(1.) Except for 11/1 Vertical
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					△	1/-		
21	Ship Motion					△	1/-		
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	C	C	C			12/0 (1.)		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Slew/Tension Indications								
32	Sled Status								

Figure 6-12-2. MC H-53 Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 2 - Orientation

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 11

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course					○	8/3		
4	Ship Course Ambiguity								
5	Pattern Orientation					○	11/0		
6	Pattern Dimensions					○	11/0		
7	Relative Wind					○	8/3	*Effect on lateral range.	
8	Signal Delta/Charlie					○	9/2		
9	Range					○	11/0	*Laterally. To set up constant 180° position.	
10	Range Rate					○	11/0		
11	Time-To-Turn Milestone					○	11/0		
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								(1.) Except for 10/2 Speed/Long'l.
18	Lateral Hover Position								" " 8/3 Vertical
19	Hover Azimuth Error								
20	Deck Status					○	10/1		
21	Ship Motion								
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	○C	○B	○C			11/0 (1.)	*Going from delta to charlie pattern. Poor 180° screws up entire approach. Starting low or high may lead to wave-off.	
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

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Figure 6-12-3. MC H-53 Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 3 - Initial Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 12

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE		PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity									
2	Inbound Heading									
3	Base Recovery Course									
4	Ship Course Ambiguity									
5	Pattern Orientation									
6	Pattern Dimensions									
7	Relative Wind					(1)	9/3			
8	Signal Delta/Charlie					△	1/-			
9	Range									
10	Range Rate									
11	Time-To-Turn Milestone									
12	Lateral Tracking Error	2B					10/2			
13	Approach Slope Tracking Error			3B			7/3		*Use VSI not altimeter (rate vs. mass).	
14	Range Milestone					(1)	10/2			
15	Obstacle Clearance									(1.) Except for 9/3 Speed/Long'l. * 8/4 Vertical
16	Relative Altitude									
17	Longitudinal Hover Position									
18	Lateral Hover Position									
19	Hover Azimuth Error									
20	Deck Status					(1)	10/2			
21	Ship Motion									
22	Wave Off					(1)	10/2			
23	Horizontal Reference									
24	Hover Height									
25	Closure Rate Error		1B				8/4			
26	Aircraft Flight Instruments	1C	1B	1C			11/1	(1.)	*Critical area of flight. Flt inst. provide cues that cause pilot to determine task limits. Altitude very critical.	
	Special Info. Req'd. Cat.									
27	Density Altitude									
28	VERTREP Load Data									
29	Aircraft Separation									
30	HIFR Status									
31	Skew/Tension Indications									
32	Sled Status									

Figure 6-12-4A. MC H-53 Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 4A - Final Initial Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 11

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course					(1)	9/2		
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind					(1)	8/3	*Determine A/C or pilot limitations.	
8	Signal Delta/Charlie					/3\	1/-		
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	*2B					10/1		
13	Approach Slope Tracking Error			3C			11/0		
14	Range Milestone					(2)	10/1		
15	Obstacle Clearance					/2\	1/-		(1.) Except for 7/4 Vertical " " 8/3 Speed/Long'l.
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	8/3		
21	Ship Motion					/2\	1/-		
22	Wave Off					(3)	11/0		
23	Horizontal Reference	1C		1C			7/4	*Not needed yet.	
24	Hover Height								
25	Closure Rate Error		1B				6/5	*Critical in H-53. Improper closure rate makes transition to a hover unsafe.	
26	Aircraft Flight Instruments	1C	1B	1C			11/0 (1.)		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-12-4B. MC H-53 Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 4B - Final Close-In Approach

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 11

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	3B	3B	3B	3B		11/0 (1.)	*No problem with this segment.	
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	2C					11/0		
13	Approach Slope Tracking Error								
14	Range Milestone								(1.) Except for 10/1 Lateral and Vertical
15	Obstacle Clearance	3B	3B	3B			11/0		
16	Relative Altitude			3C			11/0		
17	Longitudinal Hover Position		2D				9/2		
18	Lateral Hover Position	2D					9/2		
19	Hover Azimuth Error				1D		7/4		
20	Deck Status					(1)	6/5		
21	Ship Motion	2C	2C	2C			10/1		
22	Wave Off					(3)	10/1		
23	Horizontal Reference	1C	1B	1C			6/5	*Especially for H-53.	
24	Hover Height			1C			7/4		
25	Closure Rate Error		2B				7/4	*Speed Indicator in operation below 40 kts.	
26	Aircraft Flight Instruments	2B	1A	2B			9/2	*Other aircraft turning. Relation to other aircraft turning on deck.	
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-12-5. MC H-53 Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 5 - Hover

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 12

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	3B	3B	3B	3B		12/0 (1.)	By this time, I'm looking at PIL and correcting for relative wind automatically.	
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								(1.) Except for 10/2 Vertical
15	Obstacle Clearance	3B	3B	3B	3B		11/1		(2.) 2, Level #3 Instructive 1, Level #3 Instructive
16	Relative Altitude								
17	Longitudinal Hover Position		3C				12/0		
18	Lateral Hover Position	3C					12/0		
19	Hover Azimuth Error				1B		8/4		
20	Deck Status					△3	1/-		
21	Ship Motion	2D	2D	2D			11/1	Ship motion & horizon reference are interconnected. Should be in first category. For CH-53.	
22	Wave Off					△3	3/- (2.)		
23	Horizontal Reference	1B	1B	1B			9/3		
24	Hover Height			1D			11/1		
25	Closure Rate Error								
26	Aircraft Flight Instruments								
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-12-6. MC H-53 Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 6 - Vertical Landing

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 16

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					(1)	14/2	Critical if operating at limits of range & EMCON.	
2	Inbound Heading	(1B)					16/0		
3	Base Recovery Course					(1)	16/0		
4	Ship Course Ambiguity					(1)	16/0		
5	Pattern Orientation					(1)	16/0		
6	Pattern Dimensions					(1)	16/0		
7	Relative Wind					(1)	16/0		
8	Signal Delta/Charlie					(1)	16/0		
9	Range					(1)	16/0		
10	Range Rate					(1)	16/0		
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance					△	1/-		
16	Relative Altitude					△	1/-		
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	16/0		
21	Ship Motion					△	3/-	In case a larger ship or alternate is available. Nice to know for planning.	
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)		(1)	16/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Definitions

Figure 6-13-1. MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operation from LPH/LHA's, Segment 1 - Homing

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 14

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					△2	2/- 1 Lv 1, 1 Lv 2		
2	Inbound Heading	△1A					1/-		
3	Base Recovery Course					①1	11/3		
4	Ship Course Ambiguity					①1	14/0		
5	Pattern Orientation					①1	12/2		
6	Pattern Dimensions					①1	11/3		
7	Relative Wind					①1	14/0		
8	Signal Delta/Charlie					①1	12/2		
9	Range					①1	13/1		
10	Range Rate					①1	13/1		
11	Time-To-Turn Milestone					①1	14/0		
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance					△1	5/- 4 Lv 1, 1 Lv 3		
16	Relative Altitude					△1	4/- 3 Lv 1, 1 Lv 3		
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					①1	14/0		
21	Ship Motion					△3			
22	Wave Off						2/- 1 Lv 1, 1 Lv 3		
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	①1C	①1B	①1C			13/1		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	LZ Altitude					△2	1/-		

Definitions

Figure 6-13-2. MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operation from LPH/LHA's, Segment 2 - Orientation

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 12

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					△3	1/-		
2	Inbound Heading					△1	3/- 2 Lv 1, 1 Lv 2	Must know final inbound course to turn to.	
3	Base Recovery Course					○1	9/3		
4	Ship Course Ambiguity								
5	Pattern Orientation					○1	10/2		
6	Pattern Dimensions					○1	11/1		
7	Relative Wind					○1	12/0		
8	Signal Delta/Charlie					○1	11/1	Continuous information.	
9	Range					○1	10/2		
10	Range Rate					○1	12/0		
11	Time-To-Turn Milestone					○1	10/2		
12	Lateral Tracking Error					△2	1/-		
13	Approach Slope Tracking Error					△2	1/-		
14	Range Milestone								
15	Obstacle Clearance					△1	4/- 3 Lv 1, 1 Lv 3	If descending, need obstacle clearance.	
16	Relative Altitude					△3	4/- 2 Lv 1, 2 Lv 3		
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					○1	12/0		
21	Ship Motion								
22	Wave Off					△3	2/-		
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	○1C	○1B	○1C			12/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	LZ Altitude					△3	1/-		

Definitions

Figure 6-13-3. MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operation from LPH/LHA's, Segment 3 - Initial Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 10

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					△3	1/-		
2	Inbound Heading					△1	4/- 3 Lv 1, 1 Lv 3		
3	Base Recovery Course					③	1/-		
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions					①	1/-		
7	Relative Wind					①	9/1		
8	Signal Delta/Charlie					①	3/-	Continuous information. For indication of possible wave off.	
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone					①	2 Lv 1		
12	Lateral Tracking Error	△2A					9/1		
13	Approach Slope Tracking Error			△3B			9/1		
14	Range Milestone					△1	10/0		
15	Obstacle Clearance					△3	5/- 2 Lv 3, 2 Lv 1, 1 Lv 1		
16	Relative Altitude					△3	4/- 2 Lv 3, 1 Lv 1, 1 Lv 2		
17	Longitudinal Hover Position					△2A	1/-		
18	Lateral Hover Position					△2A	1/-		
19	Hover Azimuth Error								
20	Deck Status					①	10/0		
21	Ship Motion								
22	Wave Off					△1	8/2		
23	Horizontal Reference					△1	4/- 2 Lv 1, 1 Lv 2A, 1 Lv 2		
24	Hover Height								
25	Closure Rate Error		△1B				9/1		
26	Aircraft Flight Instruments	①C	①B	①C			10/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	LZ Altitude					③	1/-		

Definitions

Figure 6-13-4A. MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operation from LPH/LHA's, Segment 4A - Final Initial Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 8

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Longit.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					△3	1/-		
2	Inbound Heading					△3	1/-		
3	Base Recovery Course					△1	7/1		
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind					○1	6/2		
8	Signal Delta/Charlie					△1	3/-		
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	○2B					8/0		
13	Approach Slope Tracking Error			○3C			7/1		
14	Range Milestone					○2	8/0		
15	Obstacle Clearance					△3	6/1 2 Lv3, 2 Lv 1, 1 Lv 2, 1 Lv 2B		
16	Relative Altitude					△3	6/- 2 Lv3, 1 Lv 1, 1 Lv 2 Vert, 1 Lv 2B, 1 Lv 2		
17	Longitudinal Hover Position					△1	3/- 2 Lv 1, 1 Lv 2B		
18	Lateral Hover Position					△1	3/- 2 Lv 1, 1 Lv 2B		
19	Hover Azimuth Error								
20	Deck Status					○1	6/2		
21	Ship Motion								
22	Wave Off					○3	8/0		
23	Horizontal Reference	△1C	△1C				7/1		
24	Hover Height								
25	Closure Rate Error		○2B				8/- 3 Lv 2B, 2 Lv 1B, 1 Lv 3, 1 Lv 3D		
26	Aircraft Flight Instruments	○1C	○1B	○1C			8/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	LZ Altitude					△3	1/-		

Definitions

Figure 6-13-4B. MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operation from LPH/LHA's, Segment 4B - Final Close-In Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Tusk Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 9

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	(3B)	(3B)	(3B)	(3B)		7-3B Lav, 7-3B Long, 7-3B Vert, 7-3B Az		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	(2C)					9/0		
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	(3B)	(3B)	(3B)			7/2		
16	Relative Altitude			(3C)			7/2		
17	Longitudinal Hover Position		(2D)				6/3	Assume unprepared fwd site.	
18	Lateral Hover Position	(2D)					6/3		
19	Hover Azimuth Error				(1B)		9/0		
20	Deck Status					(2)	9/- 4Lv2, 3Lv1, 1Lv3D, 1Lv3		
21	Ship Motion	(2C)	(2C)	(2C)			9/0		
22	Wave Off					(3)	8/1		
23	Horizontal Reference	(1B)	(1B)	(1B)			7/2		
24	Hover Height			(1C)			7/2		
25	Closure Rate Error		(2B)				7/2		
26	Aircraft Flight Instruments	(2B)	(1A)	(2B)			9/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Definitions

Figure 6-13-5. MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operation from LPH/LHA's, Segment 5 - Hover

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 8

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	(3B)	(3B)	(3B)	(3B)		8-3B Lat, 7-3B Vert, √ 8-3B Sp/Long & Azim	From hover to set down, all information has been used; only visual reference used to feel for ground.	
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	(3B)	(3B)	(3B)	(3B)		7/1		
16	Relative Altitude					△2	1/-		
17	Longitudinal Hover Position		(3D)				8/0		
18	Lateral Hover Position	(3D)					8/0		
19	Hover Azimuth Error				(1B)		5/3		
20	Deck Status					△3D	1/-		
21	Ship Motion	(2D)	(2D)	(2D)			8-2D Lat, 7-2D Vert, √ 8-2D Sp/Long/A		
22	Wave Off					△3	1/-		
23	Horizontal Reference	(1B)	(1B)	(1B)			7/1		
24	Hover Height			(1B)			6/2		
25	Closure Rate Error								
26	Aircraft Flight Instruments								
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Definitions

Figure 6-13-6. MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operation from LPH/LHA's, Segment 6 - Vertical Landing

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 19

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					①	12/7	Inertial Nav. gear with accurate PIM. Vertical terrain clearance.	
2	Inbound Heading		(18)				11/8	In mountains important. Recognition terrain & trees limit visual location.	
3	Base Recovery Course					①	17/2		
4	Ship Course Ambiguity					①	16/3	2. Info fed in before mission should solve this problem.	
5	Pattern Orientation					①	17/2		
6	Pattern Dimensions					①	16/3		
7	Relative Wind					①	14/5	Gross weight may require into the wind. Obstacle clue.	
8	Signal Delta/Charlie					①	18/1	Delay time.	
9	Range					①	17/2		
10	Range Rate					①	17/2		
11	Time-To-Turn Milestone					△	1/-		
12	Lateral Tracking Error					△	1/-		
13	Approach Slope Tracking Error					△	1/-		
14	Range Milestone					△	1/-		
15	Obstacle Clearance					△	2/- 1-2B Vsr, 1-1A Vsr, 1-2C 1-3B Lsr, Inst	Black night vision of obstacles unlighted are very dangerous. Need to know if aircraft is clear.	
16	Relative Altitude					△	1/-		
17	Longitudinal Hover Position					△	1/-		
18	Lateral Hover Position					△	1/-		
19	Hover Azimuth Error					△	1/-		
20	Deck Status					△	16/3	Don't head while homing. Delay time.	
21	Ship Motion								
22	Wave Off					△	1/-		
23	Horizontal Reference					△	1/-		
24	Hover Height					△	1/-		
25	Closure Rate Error					△	1/-		
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)		①	18-1C Lsr, 18-1C Vsr, 18-Cp/Long, 19-Inst 1		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation	△3C	△3C	△3C		△3	1/-	If multi aircraft operation.	
30	HIFR Status								
31	Skew/Tension Indications								
32	LZ Size & Shape					△	2/- 1 Lv 1 Inst, 1 Lv 2 Inst		

Figure 6-14-1 MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operating from Landing Zones, Segment 1 - Homing

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 16

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					△	3/1	Hard to keep. Hard to maintain reference.	
2	Inbound Heading					△	4/-		
3	Base Recovery Course					○	14/2	Determines flight pattern, turn to downwind, etc.	
4	Ship Course Ambiguity					○	14/2		
5	Pattern Orientation					○	14/2	Wrong patterns cause wave offs & confusion.	
6	Pattern Dimensions					○	16/0		
7	Relative Wind					○	15/1	Safe areas clear. Fuel considerations will increase this.	
8	Signal Delta/Charlie					○	14/2		
9	Range					○	16/0	Obstacle free.	
10	Range Rate					○	16/0		
11	Time-To-Turn Milestone					○	16/0		
12	Lateral Tracking Error					△	5/-		
13	Approach Slope Tracking Error					△	5/-		
14	Range Milestone					△	2/-		
15	Obstacle Clearance					△	7/-		
16	Relative Altitude					△	3/-		
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					○	14/2		
21	Ship Motion					△		Helps plan final.	
22	Wave Off					△	3/-		
23	Horizontal Reference					△	1/-		
24	Hover Height								
25	Closure Rate Error					△			
26	Aircraft Flight Instruments	○1C	○1B	○1C			14- 1C Lat, Vert, 1B Sp/Long		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation	△3C	△3C	△3C		△3	1/-		
30	HIFR Status								
31	LZ Size					△	1/-		
32	Altitude of LZ					△	1/-		

Figure 6-14-2 MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operating from Landing Zones, Segment 2 - Orientation

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 14

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					△1	4/3	Small LZ hard to keep in sight.	
2	Inbound Heading					△1	5/- 2 Lv 2, 2 Lv 1, 1 Lv 2A		
3	Base Recovery Course					○1	10/4	3 if it changes. Determines this particular portion, i.e. downwind.	
4	Ship Course Ambiguity					○1	2/-	If incus or heading must know.	
5	Pattern Orientation					○1	12/2	2 of BRC changes.	
6	Pattern Dimensions					○1	13/1	For safety obstacle clearance.	
7	Relative Wind					○1	10/4		
8	Signal Delta/Charlie					○1	13/1		
9	Range					○1	12/2		
10	Range Rate					○1	14/0		
11	Time-To-Turn Milestone					○1	11/3	Rate of turn/angle of bank must be small, i.e., less than or	
12	Lateral Tracking Error					△1	1/-	equal to SRT.	
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance					△2B	6/- 3-2B, 1-2C Vert & Lat, 1-3 I	During pattern.	
16	Relative Altitude					△2B	1/-		
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					○1	11/3		
21	Ship Motion					△1	1/-		
22	Wave Off					△1	1/1		
23	Horizontal Reference					△1			
24	Hover Height								
25	Closure Rate Error			△1A			1/-		
26	Aircraft Flight Instruments	○1C	○1B	○1C			13-1C Lat, 13-1C Vert, 12-1B Sp/Long		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Altitude LZ					△1	1/1		
32	HH Obstacle Readout					△1	1/-		

Figure 6-14-3 MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operating from Landing Zones, Segment 3 - Initial Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 12

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					△2	2/- 1 Lv 2, 1 Lv 3		
2	Inbound Heading					△2	2/1		
3	Base Recovery Course					△1	1/-		
4	Ship Course Ambiguity								
5	Pattern Orientation					△1	1/-		
6	Pattern Dimensions					△1	1/-		
7	Relative Wind					○1	10/2	3B if drastic change.	
8	Signal Delta/Charlie								
9	Range					△2B	1/-		
10	Range Rate					△1	2/1		
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	○2B					12/-		
13	Approach Slope Tracking Error			○3B			11/1		
14	Range Milestone					○1	11/1		
15	Obstacle Clearance			△2B			4/- 2 Lv 2B Vert, 1 Lv 1, 1 Lv 3		
16	Relative Altitude					△1	1/-		
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					○1	11/1	LZ status if other aircraft are in LZ.	
21	Ship Motion								
22	Wave Off					○1	9/3		
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error		○1B				9/3		
26	Aircraft Flight Instruments	○1C	○1B	○1C			12-1C Lat, 12-1C Vert, 11-1B Sp/Long.		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Altitude of LZ					△3	1/-		
32	Obstacle Readout					△3	1/-		

Figure 6-14-4A MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operating from Landing Zones, Segment 4A - Final Initial Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 14

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					△3	4/- 2 Lv 3, 1 Lv 2B, 1 Lv 2		
2	Inbound Heading					○3C	3/- 1 Lv 3C, 1 Lv 3, 1 Lv 2A		
3	Base Recovery Course					○1	13/1		
4	Ship Course Ambiguity								
5	Pattern Orientation					△2C	1/-		
6	Pattern Dimensions								
7	Relative Wind					○1	10/4		
8	Signal Delta/Charlie					△1	1/-		
9	Range					△2B	2/- 1 Lv 2, 1 Lv 2B		
10	Range Rate					△2C	2/1		
11	Time-To-Turn Milestone					△1	1/-		
12	Lateral Tracking Error	○2B					11/3		
13	Approach Slope Tracking Error			○3C			11/3		
14	Range Milestone					○2	13/1		
15	Obstacle Clearance			△2			7/- 1 Lv 2, 1 Lv 2 Vert, 1 Lv 2B Vert, 1 Lv 3C Lat & Vert, 1 Lv 3C, 1 Lv 3B, 1 Lv. 3		
16	Relative Altitude					△1	2/1		
17	Longitudinal Hover Position					△1	1/-		
18	Lateral Hover Position					△1	1/-		
19	Hover Azimuth Error								
20	Deck Status					○1	12/2		
21	Ship Motion					△1	2/1		
22	Wave Off					○3	12/2		
23	Horizontal Reference	△1C	△1C				12/2		
24	Hover Height					△1	1/-		
25	Closure Rate Error		○1B				8/6		
26	Aircraft Flight Instruments	○1C	○1B	○1C			14 - 1C Lat, 12-1C Vert, 12-1B Spy/Long		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Obstacle Readout					△3	1/-		

Figure 6-14-4B MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operating from Landing Zones, Segment 4B - Final Close-In Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 13

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					△3A	2/- 1 Lv 3B, 1 Lv 3		
2	Inbound Heading					△3A	1/-		
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation					△3	1/-		
6	Pattern Dimensions					△3	1/-		
7	Relative Wind	○3B	○3B	○3B	○3B		12-3B Lat, 7-3B Vert, 12-3B Sp/Long, 12-3B Azi	Relative wind will not limit operations unless radically.	
8	Signal Delta/Charlie								
9	Range					△3A	1/-		
10	Range Rate					△3A	1/-		
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	○2D					12/1		
13	Approach Slope Tracking Error					△3	1/-		
14	Range Milestone					△3A	1/-		
15	Obstacle Clearance	○3D	○3D	○3D			8-3B Lat, 8-3B Vert, 8-3B Sp/Long		
16	Relative Altitude			○3C			12/1		
17	Longitudinal Hover Position		○2D				12/1		
18	Lateral Hover Position	○2D					12/1		
19	Hover Azimuth Error				○1B		11/2		
20	Deck Status					○1	7/6	Most important at this stage.	
21	Ship Motion	○2D	○2D	○2D			12/1		
22	Wave Off					○3	13/0		
23	Horizontal Reference	○1B	○1B	○1B			12-1B Lat, Long, Vert.		
24	Hover Height			○1C			11/2		
25	Closure Rate Error		○2B				7/6	Excessive closure should require safety war is result of vertical	
26	Aircraft Flight Instruments	○2B	○1A	○2B			13-2B Lat, 13-2B Vert, 12-1A Sp/Long.	and long. movement. Tremendously high closure rates may ruin your day.	
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-14-5 MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operating from Landing Zones, Segment 5 - Hover

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 8

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					△1	1/-		
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	○3B	○3B	○3B	○3B		7-3B Lat, 3-3B Vert, 7-3B Sp/Long, 7-3B Azi		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	○3B	○3B	○3B	○3B		4-3B Lat, 4-3B Vert, 4-3B Long, 4-3B Azi	3B (Lat, Vert, Long, Azi) & from other aircraft already landed.	
16	Relative Altitude					△3B	1/-		
17	Longitudinal Hover Position		○3D				7/1		
18	Lateral Hover Position	○3D					7/1		
19	Hover Azimuth Error				○1B		7/2		
20	Deck Status								
21	Ship Motion	○2D	○2D	○2D			6-2D Lat, 4-2D Vert, 7-3D Vert.		
22	Wave Off					△3			
23	Horizontal Reference	○1B	○1B	○1B			8/0		
24	Hover Height			○1D			7/1		
25	Closure Rate Error								
26	Aircraft Flight Instruments								
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-14-6 MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operating from Landing Zones, Segment 6 - Vertical Landing

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 11

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					(2)	7/4	Critical. Depends on # of ships in task force.	
2	Inbound Heading	(1B)					6/5	Critical.	
3	Base Recovery Course					(1)	8/3	Due to multiple flights of divisions not factor till Seg 2. Occasionally	
4	Ship Course Ambiguity					(1)	8/2	several marshalling points. Cr	
5	Pattern Orientation					(1)	8/3	Critical if you have multiple flights. Critical if you have more	
6	Pattern Dimensions					(1)	10/1	than 1 pattern.	
7	Relative Wind					(1)	9/2	Not needed. If aircraft heavy. Important to plan for crab.	
8	Signal Delta/Charlie					(1)	10/1	Nice to know.	
9	Range					(1)	7/4	Nice to know. Critical if you're low fuel state or have multiple	
10	Range Rate					(1)	10/1	flights. Several flights arriving same time. Critical fuel.	
11	Time-To-Turn Milestone							Important for fuel state considerations.	
12	Lateral Tracking Error								
13	Approach Slope Tracking Error							10. Nice to know.	
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	9/2	Nice to know.	
21	Ship Motion	△1A		△1A			1/-	Like to know.	
22	Wave Off	△1A					1/-		
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)		(1)		Nice to know.	
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-15-1 MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operating from Landing Zones, Segment 1 - Homing

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 8

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course					(2)	4/- 2 Lv 2, 2 Lv 1 √	Critical to flight pattern if multiple flts. BRC determines marshal	
4	Ship Course Ambiguity					(1)	6/2	orientation. Fixed course at SATS sight.	
5	Pattern Orientation					(2)	4/- 3 Lv 2, 1 Lv 1	Terrain clearance. Critical if multiple flights.	
6	Pattern Dimensions					(1)	7/1		
7	Relative Wind					(1)	6/2	Need to know.	
8	Signal Delta/Charlie					(1)	6/2	Numbers of aircraft. Land ops obstacle clearance takes greater	
9	Range					(1)	2/6	significance. Critical if multiple flts.	
10	Range Rate					(1)	8/0	9. Critical in mountainous terrain. Terrain clearance.	
11	Time-To-Turn Milestone					(1)	8/0		
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	8/0		
21	Ship Motion								
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)			7-1C Lat, 6-1C Vert,/ 7-1B Sp/Long	Critical if multiple flights.	
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-15-2 MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operating from Landing Zones, Segment 2 - Orientation

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 3

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course					(1)	2/1		
4	Ship Course Ambiguity								
5	Pattern Orientation					(1)	2/1		
6	Pattern Dimensions					(1)	3/0		
7	Relative Wind					(1)	2/1		
8	Signal Delta/Charlie					(1)	2/1		
9	Range					(1)	3/0	Only as to too close aboard closure rate.	
10	Range Rate					(1)	3/0		
11	Time-To-Turn Milestone					(1)	3/0		
12	Lateral Tracking Error								
13	Approach Slope Tracking Error					△3	2/- 1 Lv 2, 1 Lv 3	Downwind.	
14	Range Milestone								
15	Obstacle Clearance					△2	1/-	Mountain areas.	
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	2/1		
21	Ship Motion								
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error					△2	1/-	Multiple aircraft.	
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)			3-1C Lat, 1-1C Vert, 3-1B Sp/Long.		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

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Figure 6-15-3 MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operating from Landing Zones, Segment 3 - Initial Approach

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 6

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind					(1)	5/1		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	(2B)					2/4	Critical in mountains.	
13	Approach Slope Tracking Error			(3C)			4/- 2-3C, 2-3B	Obstacle clearance for land operations.	
14	Range Milestone					(1)	5/1		
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
	Hover Azimuth Error								
20	Deck Status					(1)	5/1		
21	Ship Motion								
22	Wave Off					(1)	5/1		
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error		(2B)				4/- 2 Lv 2B, 2 Lv 1B		
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)			5-1C Lat, 3-1C Vert, 4-1B Sp/Long.	Critical area of flight.	
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Definitions

Figure 6-15-4A MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operating from Landing Zones, Segment 4A - Final Initial Approach

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 4

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course					(1)	4/- 3 Lv 1 T, 1 Lv 2A Lat, / 1A Lat		
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind					(1)	3/- 2 Lv 1, 1 Lv 2, 1 Lv 1A Lat /		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	(2B)					4/0		
13	Approach Slope Tracking Error			(3C)			4/0		
14	Range Milestone					(2)	3/1	For preparation of wave off.	
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	3/1		
21	Ship Motion								
22	Wave Off					(3)	3/1	Have to know	
23	Horizontal Reference	(1C)	(1C)				3-1C Lat, 3-1C Sp/Long /		
24	Hover Height								
25	Closure Rate Error		(1B)				1/3	Improper closure rate makes transition to a hover unsafe.	
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)			3-1C Lat, 3-1C Vert, / 3-1B Sp/Long		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Definitions

Figure 6-15-4B MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operating from Landing Zones, Segment 4B - Final Close In Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 3

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Longit.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	(3B)	(3B)	(3B)	(3B)		3/0		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	(2D)					3/0		
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	(3B)	(3B)	(3B)			3/0		
16	Relative Altitude			(3C)			3/0		
17	Longitudinal Hover Position		(2D)				2/1		
18	Lateral Hover Position	(2D)					2/1		
19	Hover Azimuth Error				(1B)		2/1		
20	Deck Status					(2)	2/1		
21	Ship Motion	(2C)	(2C)	(2C)			3/0		
22	Wave Off					(3)	3/0	LSE signal.	
23	Horizontal Reference	(1B)	(1B)	(1B)			2-1B Lat, 2-1B Vert, 2-1B Sp/Long		
24	Hover Height			(2C)			2/1		
25	Closure Rate Error		(3B)				2/1		
26	Aircraft Flight Instruments	(2B)	(1A)	(2B)			3/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Definitions

Figure 6-15-5 MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operating from Landing Zones, Segment 5 - Hover

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 2

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	(3B)	(3B)	(3B)	(3B)		2/0		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	(3B)	(3B)	(3B)	(3B)		2/0		
16	Relative Altitude								
17	Longitudinal Hover Position		(3D)				2/0		
18	Lateral Hover Position	(3D)					2/0		
19	Hover Azimuth Error				(2B)		2/0		
20	Deck Status								
21	Ship Motion	(2D)	(2D)	(2D)			2/- 1 Lv 2D, 1 Lv 3D		
22	Wave Off								
23	Horizontal Reference	(1B)	(1B)	(1B)			2/0		
24	Hover Height			(1D)			2/- 1 Lv 1D, 1 Lv 2D		
25	Closure Rate Error								
26	Aircraft Flight Instruments								
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Definitions

Figure 6-15-6 MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operating from Landing Zones, Segment 6 - Vertical Landing

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 6

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					(2)	4/2	Primary consideration is the correct ship selection. Need to	
2	Inbound Heading	(1B)					4/2	identify ship to follow heading. We need instruction and a	
3	Base Recovery Course					(1)	6/0	visual slope indicator on the ship.	
4	Ship Course Ambiguity					(1)	6/0		
5	Pattern Orientation					(1)	6/0		
6	Pattern Dimensions					(1)	6/0		
7	Relative Wind					(1)	6/0		
8	Signal Delta/Charlie					(1)	5/1		
9	Range					(1)	6/0	Fuel/Distance capability/Limitations.	
10	Range Rate					(1)	6/0	Closure rate.	
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	6/0		
21	Ship Motion								
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)		(1)	6/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-16-1 MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operating from Landing Zones, Segment 1 - Homing

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 3

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course					(2)	3/- 1 Lv 1, 1 Lv 2, 1 Lv 3 Lat, 1 Deletion		
4	Ship Course Ambiguity					(1)	2/1		
5	Pattern Orientation					(1)	2/1		
6	Pattern Dimensions					(1)	3/0		
7	Relative Wind					(2)	1/2	Adjust pattern.	
8	Signal Delta/Charlie					(1)	2/1		
9	Range					(1)	3/0		
10	Range Rate					(1)	3/0		
11	Time-To-Turn Milestone					(1)	3/0		
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	3/0		
21	Ship Motion					△	1/-		
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)			3/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Slew/Tension Indications								
32	Sled Status								

Figure 6-16-2 MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operating from Landing Zones, Segment 2 - Orientation

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 3

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course					(1)	2/1		
4	Ship Course Ambiguity								
5	Pattern Orientation					(1)	3/0		
6	Pattern Dimensions					(1)	3/0		
7	Relative Wind					(2)	2/1		
8	Signal Delta/Charlie					(1)	2/1		
9	Range					(1)	3/0		
10	Range Rate					(1)	3/0		
11	Time-To-Turn Milestone					(1)	3/0		
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	2/1		
21	Ship Motion								
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)			3/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-16-3 MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operating from Landing Zones, Segment 3 - Initial Approach

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

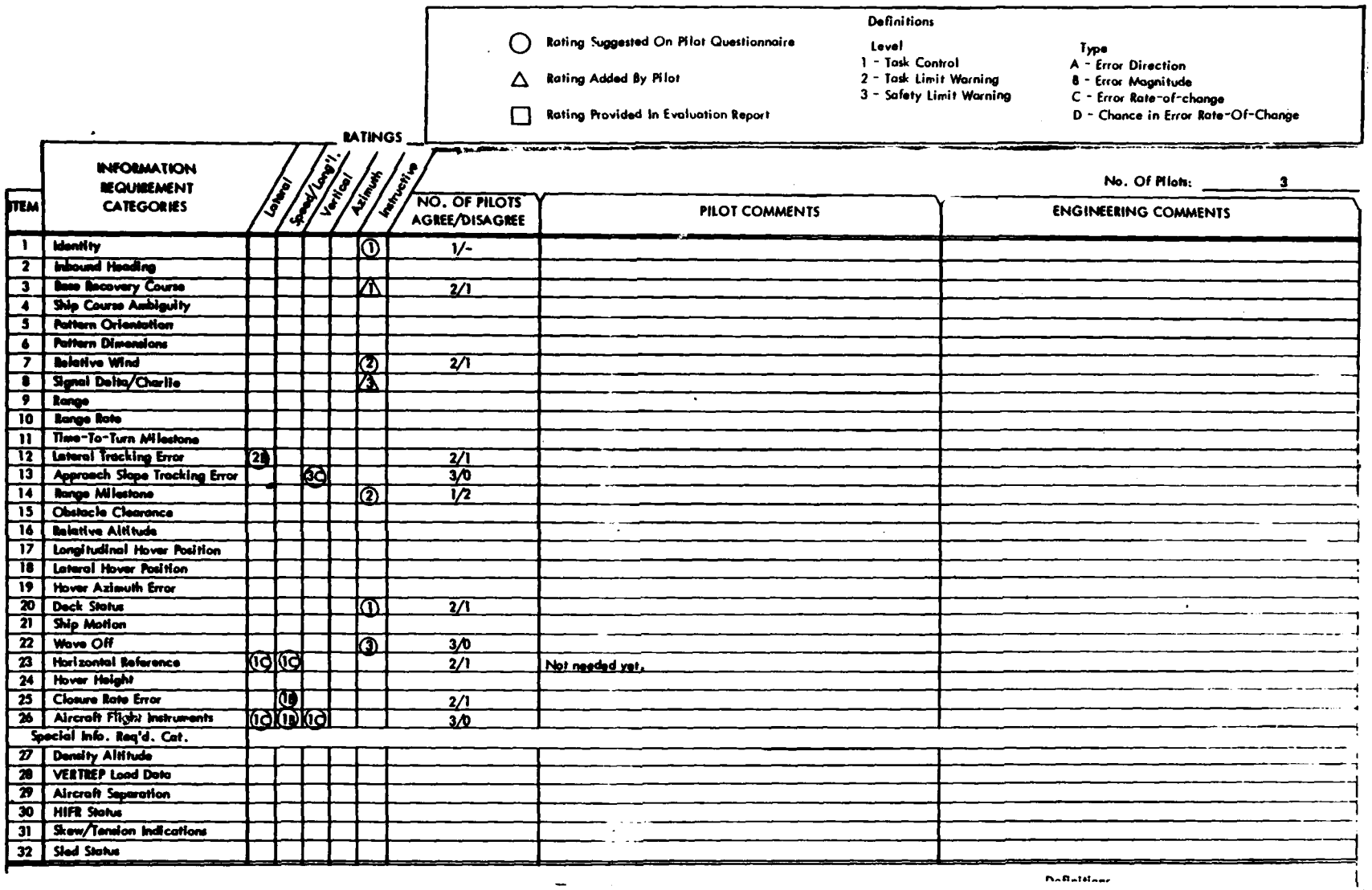
Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 3

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind					(2)	2/1		
8	Signal Delta/Charlie					(2)	1/-		
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	(2○)					2/1		
13	Approach Slope Tracking Error			(3○)			1/2		
14	Range Milestone					(1)	2/1		
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	2/1		
21	Ship Motion								
22	Wave Off					(1)	2/1		
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error		(1△)				2/1		
26	Aircraft Flight Instruments	(1○)	(1△)	(1○)			3/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-16-4A MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operating from Landing Zones, Segment 4A - Final Initial Approach



Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 3

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					○1	1/-		
2	Inbound Heading								
3	Base Recovery Course					△1	2/1		
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind					○2	2/1		
8	Signal Delta/Charlie					△3			
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	○2B					2/1		
13	Approach Slope Tracking Error			○3C			3/0		
14	Range Milestone					○2	1/2		
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					○1	2/1		
21	Ship Motion								
22	Wave Off					○3	3/0		
23	Horizontal Reference	○1C	○1C				2/1	Not needed yet.	
24	Hover Height								
25	Closure Rate Error		○1B				2/1		
26	Aircraft Flight Instruments	○1C	○1B	○1C			3/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Definitions

Figure 6-16-4B MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operating from Landing Zones, Segment 4B - Final Close-In Approach

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 3

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Longi.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	(3B)	(3B)	(3B)	(3B)		2/1		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	(2C)					2/1		
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	(3B)	(3B)	(3B)			2/1		
16	Relative Altitude			(3C)			3/0		
17	Longitudinal Hover Position		(2D)				3/0		
18	Lateral Hover Position	(2D)					3/0		
19	Hover Azimuth Error				(1B)		2/1		
20	Deck Status					(1)	2/1		
21	Ship Motion	(2C)	(2C)	(2C)			1/-		
22	Wave Off					(3)	2/1		
23	Horizontal Reference	(1B)	(1B)	(1B)			1/2		
24	Hover Height			(1C)			2/1		
25	Closure Rate Error		(2B)				1/2		
26	Aircraft Flight Instruments	(2B)	(1A)	(2B)			1/2		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-16-5 MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operating from Landing Zones, Segment 5 - Hover

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 3

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	(3B)	(3B)	(3B)	(3B)		2-3B Lat, 2-3B Vert, 2-3B Sp/Long, 2-3B Az		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	(3B)	(3B)	(3B)	(3B)		2-3B Lat, Sp/Long, Vert, Az.		
16	Relative Altitude								
17	Longitudinal Hover Position		(3D)				3/0		
18	Lateral Hover Position	(3D)					3/0		
19	Hover Azimuth Error				(1B)		2/1		
20	Deck Status					(3)	1/-		
21	Ship Motion	(2D)	(2D)	(2D)			1/2	Ship motion and horizon reference are interconnected.	
22	Wave Off					(3)	1/2		
23	Horizontal Reference	(1B)	(1B)	(1B)			1/2		
24	Hover Height			(1D)			3/0		
25	Closure Rate Error								
26	Aircraft Flight Instruments								
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-16-6 MC H-1/H-46/H-53 Survey of Pilot Information Requirements - Operating from Landing Zones, Segment 6 - Vertical Landing

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 5

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE		PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					(3)	4/1		*Distance/fuel considerations require positive position identification ASAP for safety sake.	
2	Inbound Heading	(1B)					5/0			
3	Base Recovery Course					(1)	3/2		1.* We depend largely on information given to pilot as he approaches his intended point of landing.	
4	Ship Course Ambiguity					(1)	5/0			
5	Pattern Orientation					(1)	4/1		*Need to know to decide whether to start approach on arrival.	
6	Pattern Dimensions					(1)	5/0		5.* Must have the following information: press/temp, relative wind, deck ready.	
7	Relative Wind					(1)	3/2			
8	Signal Delta/Charlie					(1)	3/2			
9	Range					(1)	5/0		*These are critical for safe landing.	
10	Range Rate					(1)	5/0			
11	Time-To-Turn Milestone								*This segment is important. Must make decisions quickly. His fuel state will determine how long he can stay on station. Need to know Metro temp, PA, to determine if he has hover performance. Need to know Bingo airfield information - where, how far, do I have fuel. Winds determine how to fly pattern, what final course, etc.	
12	Lateral Tracking Error									
13	Approach Slope Tracking Error									
14	Range Milestone									
15	Obstacle Clearance									
16	Relative Altitude									(1.) Except for 4/1 Instructive
17	Longitudinal Hover Position								*This information important to make decision early.	(2.) 2, Level #1
18	Lateral Hover Position									2, Level #2
19	Hover Azimuth Error									1, Level #3
20	Deck Status					(1)	3/2			
21	Ship Motion									
22	Wave Off									
23	Horizontal Reference									
24	Hover Height									
25	Closure Rate Error									
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)		(1)	5/0	(1.)		
	Special Info. Req'd. Cat.									
27	Density Altitude					(2)	2/-	(2.)		
28	VERTREP Load Data									
29	Aircraft Separation									
30	HIFR Status									
31	Skew/Tension Indications									
32	Sled Status									

Figure 6-17-1. MC AV-8A Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 1 - Homing

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 5

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity							*In this phase, the pilot must get some information on the ship	
2	Inbound Heading							deck status and must know his performance to determine if he	
3	Base Recovery Course					(1)	4/1	should shorten the approach or BINGO.	
4	Ship Course Ambiguity					(1)	5/0		
5	Pattern Orientation					(1)	5/0		
6	Pattern Dimensions					(1)	5/0		
7	Relative Wind					(1)	4/1		
8	Signal Delta/Charlie					(2)	4/1		
9	Range					(1)	5/0		
10	Range Rate					(1)	5/0		
11	Time-To-Turn Milestone					(1)	4/1		
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								(1.) 2, Level #2
18	Lateral Hover Position								2, Level #1
19	Hover Azimuth Error								
20	Deck Status					(1)	4/1		
21	Ship Motion								
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)			5/0		
	Special Info. Req'd. Cat.								
27	Density Altitude					(2)	4/- (1.)		
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-17-2. MC AV-8A Survey of Pilot Information Requirements - Operating from LPH/LHA's, *Segment 2 - Orientation*

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

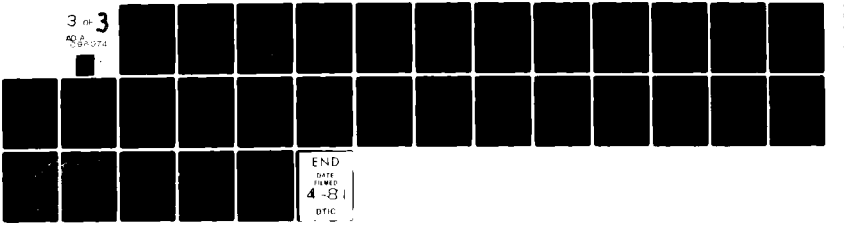
Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 5

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course					(1)	4/1	*Need to plan approach.	
4	Ship Course Ambiguity								
5	Pattern Orientation					(1)	4/1	*This section is strictly flying instruments! You've already	
6	Pattern Dimensions					(1)	5/0	made the decision to start the approach. You've determined	
7	Relative Wind					(1)	5/0	what your pattern is and what your BRC is. You've determined	
8	Signal Delta/Charlie					(1)	5/0	what your level of altitude would be, etc.	
9	Range					(1)	5/0		
10	Range Rate					(1)	5/0		
11	Time-To-Turn Milestone					(1)	5/0		
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	5/0		
21	Ship Motion								
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)			5/0		
	Special Info. Req'd. Cat.								
27	Density Altitude					△	1/-		
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-17-3. MC AV-8A Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 3 - Initial Approach

AD-A096 074 NAVAL AIR ENGINEERING CENTER LAKEHURST NJ SHIP INSTAL--ETC F/G 1/2
STUDY OF PILOT VISUAL INFORMATION REQUIREMENTS FOR NAVY VERTICA--ETC(U)
JUN 79 W S MITCHELL, C A DOUGLAS
UNCLASSIFIED NAEC-MISC-91-OR019 NL



Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 5

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE		PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity									
2	Inbound Heading					△2	1/-			
3	Base Recovery Course					△2	3/-	(1.)	*Need to know if it changes much. Once in segment 4B, AV-8 can't turn.	
4	Ship Course Ambiguity									
5	Pattern Orientation									
6	Pattern Dimensions									
7	Relative Wind					○1	5/0		*This segment is a transition segment in that you will go from	
8	Signal Delta/Charlie								directly instrument flying to both instruments and attempt to go	
9	Range								visual. This portion of the azimuth and glide slope information	
10	Range Rate								is very critical. Range is critical because without CCA you	
11	Time-To-Turn Milestone								don't know when to go to 40 nozzle. Need to know range for	
12	Lateral Tracking Error	□2B					5/0		putting gear and nozzles down.	
13	Approach Slope Tracking Error			□3B			5/0			
14	Range Milestone					○2	2/3	(2.)		(1.) 2, Level #1
15	Obstacle Clearance									1, Level #2
16	Relative Altitude									(2.) 2, Level #1
17	Longitudinal Hover Position									2, Level #2B Speed/Long'l.
18	Lateral Hover Position								*During this segment, must have something to cue distance and	1, Level #2 Speed/Long'l.
19	Hover Azimuth Error								looking for visual reference for hover.	2, Level #1
20	Deck Status					○1	3/2			(3.) Except for 4/1 Vertical
21	Ship Motion									
22	Wave Off					○1	4/1			
23	Horizontal Reference									
24	Hover Height									
25	Closure Rate Error		□1B				5/0			
26	Aircraft Flight Instruments	□1C	□1B	□1C			5/0	(3.)	*Need to know exact altitude because 400' straight in leaves	
	Special Info. Req'd. Cat.								little ground clearance. Also, it affects distance and con-	
27	Density Altitude								sequently transition point at which glide slope intercepted.	
28	VERTREP Load Data								NOTE: segment depiction.	
29	Aircraft Separation									
30	HIFR Status									
31	Skew/Tension Indications									
32	Sled Status									

Figure 6-17-4A. MC AV-8A Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 4A - Final Initial Approach

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 5

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE		PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity									
2	Inbound Heading									
3	Base Recovery Course					(1)	4/1		*Full visual stage. This phase picking up the ball is very im-	
4	Ship Course Ambiguity								portant! The pilot scan goes completely outside so you need a	
5	Pattern Orientation								very good glide slope and azimuth cue. You need a cue at 1	
6	Pattern Dimensions								mile so that you can go the hover stop. You must know if you	
7	Relative Wind					(1)	3/2		have a ready deck and wave-off cue is mandatory. You need a	
8	Signal Delta/Charlie								LSO (Landing Safety Officer) and he has to have a radio as a	
9	Range								back-up for safety reasons. Segment 4B is primarily visual	
10	Range Rate								approach criteria in AV-8A. Range rates and relative clear-	
11	Time-To-Turn Milestone								ance are very important tho' controlled primarily through total	
12	Lateral Tracking Error	(2B)					4/1		VFR outside the cockpit scan.	
13	Approach Slope Tracking Error			(3C)			5/0			
14	Range Milestone					(2)	4/1		12.* Critical if line-up lights are on angle deck. AV-8A	
15	Obstacle Clearance					(3)	2/-	(1.)	can't turn @ 30-90 knots.	(1.) 1, Level #2
16	Relative Altitude					(2)	1/-			1, Level #3
17	Longitudinal Hover Position									(2.) Except for 4/1 Speed/Long'l.
18	Lateral Hover Position									
19	Hover Azimuth Error									
20	Deck Status					(1)	3/2		*Need to decide whether to wave-off. Must be done in this seg-	
21	Ship Motion								ment.	
22	Wave Off					(3)	5/0			
23	Horizontal Reference	(1C)	(1C)				5/0			
24	Hover Height									
25	Closure Rate Error		(1B)				3/2		*Must know because: 1) if too fast going into segment, 5 must	
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)			5/0	(2.)	wave-off; 2) if too slow and using water injection, could run	
	Special Info. Req'd. Cat.								out of water and couldn't hover.	
27	Density Altitude									
28	VERTREP Load Data								26.* Must use to ensure sufficient closure.	
29	Aircraft Separation									
30	HIFR Status									
31	Skew/Tension Indications									
32	Sled Status									

Figure 6-17-4B. MC AV-8A Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 4B - Final Close-In Approach

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 5

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Longit.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	3B	3B	3B	3B		5/0	•Direction is most important. This phase is strictly visual. You need a good visual cue for altitude and line-up and fuel/AFT position. The pilot scan is outside totally. Landing site information is the same requirement.	
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	2C					5/0	•VFR outside cockpit scan only - no HUD or other instrumentation presently available can substitute for seeing position and drift.	
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	3B	3B	3B			5/0		
16	Relative Altitude			3C			5/0		
17	Longitudinal Hover Position		2D				5/0		
18	Lateral Hover Position	2D					5/0		
19	Hover Azimuth Error				1B		5/0		
20	Deck Status					1	3/2	•Couldn't perform task if deck fouled.	
21	Ship Motion	2C	2C	2C			5/0		
22	Wave Off					3	5/0		
23	Horizontal Reference	1B	1B	1B			5/0		
24	Hover Height			1C			3/2	•If you level off abruptly, too high, you'll lose sight of line-up lights plus either side of floodlighted ship.	
25	Closure Rate Error		2B				3/2		
26	Aircraft Flight Instruments	2B	1A	2B			5/0		
	Special Info. Req'd. Cat.							25. • If closing too fast, you must have large flare. With AV8A cockpit, this means losing sight of line-up lights and deck and possibly other visual cues.	
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-17-5. MC AV-8A Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 5 - Hover

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Addud By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 5

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	3B	3B	3B	3B		5/0	*For landing the pilot references are totally outside. You need good cues so that you can hover. The same cues apply to both the helo and the AV8A. You need to know what your sink rate is once you start down. You need some way of determining that you are cleared to land by the LSO.	
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	3B	3B	3B	3B		5/0		
16	Relative Altitude								
17	Longitudinal Hover Position		3D				5/0		
18	Lateral Hover Position	3D					5/0		
19	Hover Azimuth Error				1B		4/1		
20	Deck Status								
21	Ship Motion	2D	2D	2D			5/0		
22	Wave Off								
23	Horizontal Reference	1B	1B	1B			5/0		
24	Hover Height			1D			4/1		
25	Closure Rate Error								
26	Aircraft Flight Instruments								
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-17-6. MC AV-8A Survey of Pilot Information Requirements - Operating from LPH/LHA's, Segment 6 - Vertical Landing

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 5

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity					(3)	4/1	3. *If it is the only place you can land, AV-8A operations	
2	Inbound Heading	(1B)					4/1	depend largely on info given to the pilot as he approaches	
3	Base Recovery Course					(1)	3/2	his intended point of landing. Must have following info:	
4	Ship Course Ambiguity					(1)	5/0	press/temp, relative wind, deck ready.	
5	Pattern Orientation					(1)	4/1		
6	Pattern Dimensions					(1)	4/1		
7	Relative Wind					(2)	4/1		
8	Signal Delta/Charlie					(2)	2/3		
9	Range					(1)	5/0		
10	Range Rate					(1)	5/0	*These items are critical for safe landing.	
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								(1.) Except for 4/1 Instructive
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	3/2		
21	Ship Motion								
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)		(1)	5/0 (1.)		
	Special Info. Req'd. Cat.								
27	Density Altitude					(2)	2/3		
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-18-1. MC AV-8A Survey of Pilot Information Requirements - Operating from Tactical Sites, Segment 1 - Homing

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 5

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course					(1)	4/1		
4	Ship Course Ambiguity					(1)	4/1		
5	Pattern Orientation					(1)	3/2		
6	Pattern Dimensions					(1)	4/1		
7	Relative Wind					(2)	3/2		
8	Signal Delta/Charlie					(2)	3/2		
9	Range					(1)	5/0		
10	Range Rate					(1)	5/0		
11	Time-To-Turn Milestone					(1)	4/1		
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance								
16	Relative Altitude								
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	3/2		
21	Ship Motion								
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)			5/0		
	Special Info. Req'd. Cat.								
27	Density Altitude					(2)	3/2		
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-18-2. MC AV-8A Survey of Pilot Information Requirements - Operating from Tactical Sites, Segment 2 - Orientation

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 5

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course					(1)	4/1	Segment 3 is basically an instrument situation. Remembering that	
4	Ship Course Ambiguity							all those necessary bit of info have been satisfied prior to	
5	Pattern Orientation					(1)	4/1	leaving seg 2. These bits include: terrain clearance, press	
6	Pattern Dimensions					(1)	5/0	temp, pattern altitude, pattern direction, bingo info, rel	
7	Relative Wind					(1)	3/2	wind, pad status.	
8	Signal Delta/Charlie					(1)	5/0	7, Need on hand to plan approach.	
9	Range					(1)	5/0		
10	Range Rate					(1)	5/0		
11	Time-To-Turn Milestone					(1)	5/0		
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance					△	2/-		
16	Relative Altitude					△	3/2		
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	5/0		
21	Ship Motion								
22	Wave Off								
23	Horizontal Reference								
24	Hover Height								
25	Closure Rate Error								
26	Aircraft Flight Instruments	(1C)	(1B)	(1C)			5/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-18-3. MC AV-8A Survey of Pilot Information Requirements - Operating from Tactical Sites, Segment 3 - Initial Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 5

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE		PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity									
2	Inbound Heading					△	1/-			
3	Base Recovery Course					△	2/-			
4	Ship Course Ambiguity									
5	Pattern Orientation									
6	Pattern Dimensions									
7	Relative Wind					(1)	2/1	(1.)		
8	Signal Delta/Charlie									
9	Range					△	1/-			
10	Range Rate					△	1/-			
11	Time-To-Turn Milestone									
12	Lateral Tracking Error	2B					3/-	(2.)		
13	Approach Slope Tracking Error		3B				3/-	(3.)		
14	Range Milestone					(1)	3/-	(4.)		(1.) 2 Deletions
15	Obstacle Clearance					3	1/-	(5.)	"400' straight-in requires that obstacles be known.	(2.) " "
16	Relative Altitude					△	2/-	(6.)		(3.) " "
17	Longitudinal Hover Position									(4.) " "
18	Lateral Hover Position									(5.) " "
19	Hover Azimuth Error									(6.) " "
20	Deck Status					(1)	2/-	(7.)		(7.) " "
21	Ship Motion									(8.) " "
22	Wave Off					(1)	3/-	(8.)		(9.) " "
23	Horizontal Reference					△	1/-			(10.) " "
24	Hover Height									
25	Closure Rate Error		1B				3/-	(9.)		
26	Aircraft Flight Instruments	1C	1B	1C			3/-	(10.)		
	Special Info. Req'd. Cat.									
27	Density Altitude									
28	VERTREP Load Data									
29	Aircraft Separation									
30	HIFR Status									
31	Skew/Tension Indications									
32	Sled Status									

Figure 6-18-4A. MC AV-8A Survey of Pilot Information Requirements - Operating from Tactical Sites, Segment 4A - Final Initial Approach

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 4

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course					(1)	4/0		
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	3A	3A				1/3	* Critical to decelerate approach from other than straight into wind.	
8	Signal Delta/Charlie								
9	Range					△2	1/-		
10	Range Rate					△2	1/-		
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	2B					3/1		
13	Approach Slope Tracking Error			3C			4/0		
14	Range Milestone					(2)	2/2		
15	Obstacle Clearance					△3	1/-		
16	Relative Altitude					△3	2/-	*Need to clear approach obstacles.	
17	Longitudinal Hover Position								
18	Lateral Hover Position								
19	Hover Azimuth Error								
20	Deck Status					(1)	3/1		
21	Ship Motion								
22	Wave Off					(3)	4/0		
23	Horizontal Reference	△1C	△1C				4/0		
24	Hover Height								
25	Closure Rate Error		1B						
26	Aircraft Flight Instruments	1C	1D	1C			2/2 3/1		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-18-4B. MC AV-8A Survey of Pilot Information Requirements - Operating from Tactical Sites, Segment 4B - Final Close-In Approach

Definitions

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 4

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	3B	3B	3B	3B		4/0	Looks good.	
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error	2C					4/0		
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	3B	3B	3B			4/0		
16	Relative Altitude			3C			4/0		
17	Longitudinal Hover Position		2D				4/0		
18	Lateral Hover Position	2D					4/0		
19	Hover Azimuth Error				1B		4/0		
20	Deck Status					1			
21	Ship Motion	2C	2C	2C			3/1		
22	Wave Off					3	4/0		
23	Horizontal Reference	1B	1B	1B			4/0		
24	Hover Height				1C		2/2		
25	Closure Rate Error		2B				3/1		
26	Aircraft Flight Instruments	2B	1A	2B			4/0		
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-18-5. MC AV-8A Survey of Pilot Information Requirements - Operating from Tactical Sites, Segment 5 - Hover

○ Rating Suggested On Pilot Questionnaire

△ Rating Added By Pilot

□ Rating Provided In Evaluation Report

Definitions

Level
1 - Task Control
2 - Task Limit Warning
3 - Safety Limit Warning

Type
A - Error Direction
B - Error Magnitude
C - Error Rate-of-change
D - Chance in Error Rate-Of-Change

No. Of Pilots: 4

ITEM	INFORMATION REQUIREMENT CATEGORIES	RATINGS: Lateral	Speed/Long'l.	Vertical	Azimuth	Instructive	NO. OF PILOTS AGREE/DISAGREE	PILOT COMMENTS	ENGINEERING COMMENTS
1	Identity								
2	Inbound Heading								
3	Base Recovery Course								
4	Ship Course Ambiguity								
5	Pattern Orientation								
6	Pattern Dimensions								
7	Relative Wind	3B	3B	3B	3B		3/1		
8	Signal Delta/Charlie								
9	Range								
10	Range Rate								
11	Time-To-Turn Milestone								
12	Lateral Tracking Error								
13	Approach Slope Tracking Error								
14	Range Milestone								
15	Obstacle Clearance	3B	3B	3B	3B		3/1		
16	Relative Altitude								
17	Longitudinal Hover Position		3D				3/1		
18	Lateral Hover Position	3D					3/1		
19	Hover Azimuth Error				1B		3/1		
20	Deck Status								
21	Ship Motion	△2D	△2D	△2D			3/1		
22	Wave Off								
23	Horizontal Reference	1B	1B	1B			3/1		
24	Hover Height			1D			3/1		
25	Closure Rate Error								
26	Aircraft Flight Instruments								
	Special Info. Req'd. Cat.								
27	Density Altitude								
28	VERTREP Load Data								
29	Aircraft Separation								
30	HIFR Status								
31	Skew/Tension Indications								
32	Sled Status								

Figure 6-18-6. MC AV-8A Survey of Pilot Information Requirements - Operating from Tactical Sites, Segment 6 - Vertical Landing

SECTION VII. PILOT STATEMENTS

The pilot interview questionnaire asked 98 participating pilots three questions concerning visual landing aids. The responses to these questions are tabulated in this section by the branch of service and aircraft type.

A. Visual cue sources during night operations. (What informal cue sources do you use in night ops to obtain essential info: gimmicks like discrete alignment of ship structural elements, etc.?)

H-1, Marine

Primarily, aircraft instruments.

Mast light is 175' above sea level on LPH. It should not be level with horizon until after the 90° position.

Cue sources on final: ship's tower lights, deck lights, spot line-up lights, and finally, LSE lights.

Cues which I use are the landing signal enlisted and light reflected off the landing spot. The lighting arrangement on the LPH is poor. The 45° line-up line on a LPD is much longer and much brighter with more lights on the line-up.

I use the bridge as a visual cue and the LSE.

Cues: Few, if any, discrete cues are used until segment 4B when the flight deck becomes the visual horizon and this cue is used until segment 6.

Depends on spot.

Bridge height is good for crossing the deck.

H-2, Navy

Night operations conducted prior to inclusion of VLA equipment. All approaches were self-contained from cockpit info (e.g., rad. alt., VSI, TACAN, etc.). Co-pilot would provide advisory info and advise when pre-briefed limitations were exceeded.

Ship's NAV lighting provides the only cues beyond actual VLA/flight deck lighting for general orientation around the ship. Beyond general outline of superstructure, visibility of the ship at night is nil.

Use co-pilot to give vocal A/S, altitude info during 4A, 4B, and 5 phase of flight.

Cue use for line-up lights/centerline.

Ship structure elements in line-up - Motion of high and low objects on deck or hangar.

Informal cues - lighting of deck - wake of ship - mast lights and running lights; all to determine or picture in my mind where the ship is relative to me. Combined with GSI information and cockpit information to effect a transition to a hover over the deck.

During phase 4, I utilize drop-line and the strobes to set myself up for line-up. The two give me excellent visual cues as to relative position of A/C to ship.

Proper lighting (are all lights on, how bright). Activity on flight deck (LSE or LSO visible). Ship pitch and roll characteristics (movement of key lights and side lights).

I rely on my co-pilot for line-up, height and closure speed as a back-up for my own visual cues. If the co-pilot is giving timely information, the approach is not too difficult until crossing the deck. My biggest assist in centering the aircraft over the deck is the center circle lights. I have used the GSI one time and it appeared to be a most invaluable system. I need more work with it to become proficient.

Have never flown GSI approach. Presently use ship lighting, deck obstacles, i.e., hangar, gun mounts, etc.

Hover with hangar top at eye level. Keep all control inputs positive to keep from "flying the ship."

Outline of hangar and hangar rail on flight deck.

Ships wake, surrounding water and size of LSE in close.

H-46, Navy

Hangar top (AFS, AOE) lights on hangar.

Use different light alignments and use height of certain items on superstructure in front of me for altitude.

Night ops - Essential information. Mast and range light of ship when in appropriate quadrants; also running lights. In close, the size of superstructure tells something of distance to ship and changes give information on closure rate.

The closure rate between aircraft and ship is almost impossible to discern or find at night. There are virtually no cues available to aid in flying this closure rate. Perhaps only the slight difference and relative movement in the flight deck lights. A system that could give relative closure rate for the last $\frac{1}{2}$ mile to ship would be very helpful. There are also no good cues to establish altitude above the water during the final approach. The only real help is the radar altimeter in the aircraft itself and little as far as a visual reference. I have almost put the helo in the water for lack of any visual reference or to altitude on final.

Use alignment lights, spacing of lights (vert. dist.) lighting scheme (position) and brightness (hovering distance).

Top of hangar on AFS. Main deck lights. (Red lens in port security lights) shining down at water provides depth of vision cue.

a. Mast head & range lite relative position to determine ships head and direction of travel.

b. Silhouette of ships structure (particularly VERTREP tower). Sometimes you can use moon or an alongside ship's lights to outline home plate.

c. Ship, particularly AFS, will sometimes turn on PIL red lights along fork-truck passageways and bridge giving good outline of ship w/o destroying night vision.

Night visual cues include, but not limited to:

1) VERTREP deck lighting (red)
2) Deck edge lights
3) Line-up lights

4) Stern lights
5) LSE in light suit
6) Raising hangar doors approx. 1 ft. w/white back lighting for simulated deck horizon/visual reference
7) Ship running lights

H-46, Marine

Yellow gear on flight deck can be used for relative motion in segment 5 since it reflects the red moon beams.

At night I stay on instruments until 90° approach position for primary altitude reference. I prefer to enter "D" first to ascertain ships heading, which end is which, and to note deck lighting. At 90° position, I ascertain closure rate by rate lights on ship separate. Watch A/C airspeed and rate of descent which I attempt to stabilize, and attempt to sight linesman or object I know size and then can interpret closure rate.

LPH Guam has a quantum leap above other LPH's in fleet with new lighting systems. Hangar and 01 & 02 level lighting; 03 level being flight deck.

For determining position of landing spots on ship (LPH), the use of the ships superstructure. Also the lights on the ship.

Race Track pattern using ships BRC fly downwind reciprocal man on left seat guide you with VFR vectors as to heading and line up you are on gages til after 180°.

Crew coordination pilot in control on instrument for upwind, turn and downwind. Co-pilot is using visual indications and monitoring engine/transmission gauges. At 180° position pilot at controls switches from gauges to visual and other pilot monitors airspeed and altitude and cockpit indications. Visual approach references are ship's lights and outline.

H-53, Marine

Once established downwind, utilize hangar deck lights if door is open to pick up alt. reference and closure rate. Current LPH lighting does not give sufficient reference to determine (1) closure rate, (2) altitude or even see the deck.

Primary instruments used by me are the attitude gyro, airspeed indicator, VSI and radar altimeter. The other instruments are glanced at but unless something unusual is noted, I don't pay much attention to them. Outside sign is included to set up for the pattern and my relative position to the ship. Most visual cues occur on final and over the deck edge.

AV-8A, Marine

Ship's island.

On a fixed wing carrier, we (AV-8) used the round down and the top of the "Cherry Picker" crane to the right of the wires. The crane was good for hover altitude and positioning abeam the intended point of landing. The round down passing under the nose as cue for disregarding the ball for glide slope and transitioning to level off watching crane and line up. Some pilots used rotating clear deck recovery light by Pri-Fly as altitude reference.

B. Adequacy of present VLA suits. (How do you feel about the adequacy of present VLA suits with respect to all potential landing/hovering/HIFR, etc. sites?)

H-1, Marine

Satisfactory

Bridge height is good for crossing the deck.

Good on ships where used.

VLA suits are too dim for what I consider adequate references. This comment must be tempered with the fact that moon beams and other lights were being used, therefore diminishing the VLA light source.

On the LPH & LPD, the only VLA are the LSE and the 45° line up lights.

On the LPH, the present system works but it's never utilized the way it was designed to be used; i.e., the 45° lights on the spot (lateral & approach error) work fine, but the system is seldom up (six months at sea I never shot a night approach with any angle lights). The LSE and his lighted suit offer a hover altitude and drift reference if the suit is bright enough to see.

Very good.

Deck lighting is generally inadequate. Alignment type lighting in particular needs improvement. LSE light suits are generally poor, either too dim or intermittent.

H-2, Navy

It appears we remain tied to VLA that originate at ship of absolute no value in conditions of low visibility. Need to develop a "needles" system similar to CV fixed wing approach system.

Present VLA is generally adequate for night landings; however, HIFR/hover operations are limited due to orientation of VLA mainly for actual landings.

VLA with respect to FF with VGSI very good; however, all ships not standardized (have different equipment installed), so approach techniques necessarily different.

Very difficult without horizon reference for vertigo control. Range is needed. More stable GSLI needed on 1052 Class.

Not adequate for any sea-state greater than 2-3.

Much prefer the packages on Canadian and British Frigates. We could possibly learn from their successes.

SGSI excellent at this time. With tailwind at night, however, closure rate to ship is difficult to discern and corresponding GSI info. can become more difficult to properly evaluate.

Not adequate for landing phase during moderate to high sea states.

The VLA package on the 1052's is good. The GSI will greatly enhance the pilot's ability to make safe night conditions.

Something (GSI is always better than nothing). Have heard good things about GSI and most seem to feel it is adequate for this demanding environment.

Hangar door face lighting should be standardized white. Red lighting gives no depth perception.

GSI has greatly improved approach phase, especially with respect to altitude information. Still is a necessity for closure rate error information; must rely now on relative size of ship/landing area with no other cues or aids.

H-46, Navy

Totally inadequate on small AE decks I dealt with.

Present VLA package aboard service force ships is very inadequate. This is also true of most amphibs. The lights and associated gear are basically designed for a VFR night w/a horizon. The transition phase from IFR flying to visual contact with ship is unsatisfactory since the cues received from ships VLA are not as complete as IFR instruments in the cockpit; therefore, the pilot is not able to fly to the limits of safe operations once the transition to visual on current VLA package aboard Service Force ships and amphibs.

Not fooling with any of these for ships other than the hull.

Suits are cumbersome and not bright enough.*

Very adequate.*

I have never seen VLA systems.

VLA suits, when operable, are excellent references for night operations, providing both clarity for signals and an excellent "close-in" visual reference.*

H-46, Marine

VLA suits are useful for determining what signal LSE thinks he is giving (no substitute for well trained LSE).

Would like to see uniform lighting of type ships to aid in identification and the continued use of lighted LSE suits to aid in determining closure rate when close to landing. Don't illuminate large areas in red light as with its long wave length, it impedes focus and therefore depth perception.

Standardization of color of lights for VLA is poor; land versus sea.

Present illumination of deck and obstacles is inadequate. Moon beam intensity is too intense when turned up to provide adequate lighting.

H-53, Marine

Current VLA unsatisfactory. LPH lights (red) cannot give pilot good visual reference. LSE suit lights weak and visible only $\frac{1}{4}$ mile or less.*

VLA suits are very inadequate. Too dim! Many nights the LSE can't be seen 'til within $\frac{1}{4}$ mile.

---

* It appears that the term "VLA suit" used in the pilot questionnaire (meaning the complete VLA system) was interpreted here as referring to the LSE suit.

AV-8A, Marine

The mirror/lens is a good system, especially if it's rolled or moved back to allow you to come to a hover w/a centered ball. Line up lights are still essential and a radar altimeter. This method was many times better than having to transition off the ball.

C. VLA recommendations. (What are your VLA recommendations?)

H-1, Marine

I would like to see an LPH equipped with VLA in the following manner: 1) equip LPH/LPD's with a visible radar (capability that exists today is inadequate for night operations; 2) equip spots 2, 3, 4, 5, & 7 with VLA at deck edge; 3) the VLA for each spot would be turned on just prior to A/C reaching the 90° position, while on final (LPH) A/C would pick up VLA for final visual approach to spot; 4) LSE would be picked up just prior to A/C crossing deck edge; 5) signals from LSE used to land. However, and this may be academic, the radar/TACAN capability of today's LPH/LPD's are not adequate to handle night operations even if VLA's were available; they are not reliable.

Brighten lights.

Need to develop a "needles" system similar to CV fixed wing approach system. We need an "ILS" system.

The LPD & LPH could use some type of GAIL system. The radar and NAVAIDS on these ships are probably the worst in the Navy.

The LPH with a glide slope indicator would be wonderful. The LPD would be much easier to equip though.

Something maintainable by Marines.

Should have lites on 45° bearing vice; one on each end of it.

H-2, Navy

Improved VLA as proposed in presentation appears to satisfy the needs of helicopter operations aboard non-aviation ships under present circumstances. However, with the inclusion of MK III and the 4 hr. missions under increased sea states/reduced meteorological conditions, the pilot work load will be appreciably increased. The fatigue factor created by the stressful conditions

of flying at low altitudes under IMC for prolonged periods will most probably restrict (reduce) the pilot's ability to perform at peak efficiency. Coupled with further complications (sea state 5+) A/C systems degradation, EMCON, etc., and the stage is set against the aircrew. Therefore, the emphasis should not be on visual cues but rather on an automated landing system. Monies obligated for sophisticated VLA packages will have limited improvement if the pilot's response time has been greatly reduced. EMCON poses a special restriction on locating a single ship that has been steaming independently for several hours. Would it not be more beneficial to enhance the aircrew's capability to return unaided through such means as an inertial navigation system capable of analyzing and compensating for existing winds? Once overhead the ship, a laser guided (?) automatic approach and landing would be of substantial benefit to a tired aircrew.

It is becoming an ever popular belief among safety personnel that accidents previously attributed to "pilot error" may have been the result of a pilot subjected to a workload beyond his capabilities (beyond anyone's capabilities). This is what I foresee as the future for LAMPS pilots.

However, until the requirement is generated by proper authority and contractors are tasked to develop the equipment to lessen the workload, the VLA package is the next best thing.

We need an "ILS" system.

One primary addition to VLA which would aid landings on rolling decks, plus aid HIFR/hover operations, would be a stabilized horizon bar. This could be indexed to provide an indication of magnitude of ship's motion.

Ship's heave (vertical and lateral motion) is a considerable problem in sea state 3 and above. Maintaining a steady hover over landing site very difficult. Horizon presentation and/or lateral and vertical direction cues should be available.

Possible radar link to A/C to indicate range to landing area. Need cockpit indication for out of sight conditions indicating deck status. Need rate of closure to landing area from about 1/½ mile into landing area.

Require an artificial horizon (lighted for night operations). Pitch indicator (ship), and rate of closure system - to identify excessive rates at night.

Recommend change color scheme of present GSI to conform to standard color scheme, i.e., green/amber/red.

Install SGSI on all aviation facility ships, and restrict night operations on those ships, and restrict night operations on those ships that do not have it installed.

Current GSI so small it's difficult to find (and sometimes distinguish colors) at distance, then it is too bright in close. Because it's so small, horizon information is useless - recommend wider GSI lens for these reasons.

H-46, Navy

Some type of visual cockpit display that allows the pilot to fly the final approach as if he were in a simulator (T.V. screen type). This could also be coupled to the flight controls for automatic approaches.

A glide slope indicator (visual) that compensates for ship pitch and roll and a relative wind indicator in the A/C. I do not feel that VERTREP could ever be done completely on instruments with the H-46 due to no doppler and head programming for level fuselage. Swinging loads extremely high power settings also add to the problem.

Recommendations: Upgrade navigation systems on all ships, i.e., TACAN and LF. GSI should be mandatory for night certification, either Level I or II. Instrument approaches need to be certified aboard each ship and require qualified people on board for control if operating helos at night.

Main deck lighting as indicated in #1 above. Scoreboard type of display of information, i.e., load weight, wind, destination, heading, BRC, etc.

Hurry!!

H-46, Marine

VLA - we need something similar to CVA lens set-up, perhaps VLA approach to pt. abeam spot 7 on LPH the reposition up port side to specific spot.

If information in segments which is instructive changes its level, should be raised to allow pilot to change.

For LPH/LHA/Aviation facility ships/Non-aviation facility ships should use white floodlights for the deck areas as is now the case on CV's. LPH/LHA/LPD/LSD's should have the landing TEE's/crosses lighted completely in a color contrasting the white floods. The use of drop lights on LPH/LHA/LSD/LPD would greatly facilitate line up and descent control during the final phases of landing.

Putting deck lights in series on the ⊥ and 45° line ⊥ on LPH deck will help with line.

Possible use of a VASI system for Approach Lighting.

Visual Landing Aids on LPD & LPH need visual glide slope, so can see night approach 200 feet + 1 mile. Also lighting for 45° on spot line up. Drop-line lights on side of spot.

Improved ship lighting for better references.

Possible use of a VASI system for approach lighting.

Drop lights on side of ship and end.

Wide angle glide slope indicator set up on pri-fly so you arrive at 50 ft. over spot 5. Transition from WAGSI to spot is sometimes difficult.

H-53, Marine

Recommend that LPH on aviation facility ships convert to white lights, and make them work. Lighting on USS GUAM is what ships need.

Many of the VLA's on LPH's don't work. They aren't properly maintained. The red lighting is very poor. Almost any change in the lighting would be an improvement.

Aviation ships need a good, safe, and simple system for visual approach under stated conditions. This would increase the safety margin. Paramount though, the system must be simple for quick assimilation, and correction can be immediately taken by the pilot.

AV-8A, Marine

I believe that a meatball type system with lineup lights and drop-lights down the side of the ship with some type of range warning system (VASI-type?) to let the pilot know when to put the gear down, then the nozzles, would be ideal.

The following is a general statement from a Marine H-46 pilot which does not answer any of the three questions specifically, but is considered relevant and therefore included in this section.

> Initial critical info is location, status, range, & movement of carrier; you must intercept ship to land. With multiple A/C ops, aircraft/flight separation, flight deck status, & fuel availability are critical. The basic approach is on instruments (relative wind, altitude readout, A/C separation, & deck status are critical here). At the abeam position (must be identifiable) the base turn is commenced considering relative wind and ship movement. At the 90 rate of closure, glide slope, relative wind, & visual intercept angle become critical. As the A/C crosses flight deck the closure rate, intercept angle, air speed, & descent rate must be under positive control & minimized. Visual reference is required -- no horizon reference is necessary. The vertical descent to the flight deck is critical in relation to obstacle clearance, descent rate, visual reference with flight deck, & zero relative movement during descent.

SECTION VIII. TYPICAL VISUAL LANDING AID CONFIGURATIONS

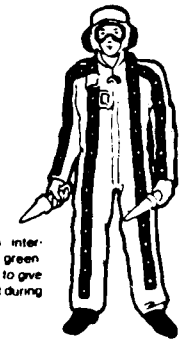
This section provides the typical VLA configurations for LPH/LHA's (Figure 8-1), air capable ships (Figure 8-2), and 600' tactical sites (Figure 8-3). The VLA briefly described in the drawing consists of the following components:

1. Homing beacon
2. Rotary beacon signal system
3. Stabilized glide slope indicator
4. Wave-off/cut lights
5. Overhead floodlights
6. AV-8 STOL line lights
7. Deck surface floodlights
8. AV-8 nozzle rotation lights
9. Vertical drop-line lights
10. Portable helicopter landing spotlight
11. Helicopter landing spotlight
12. Deck edge lights
13. Landing/VERTREP line-up lights
14. Deck status lights
15. Hangar wash lights
16. HIFR heading lights
17. Extended line-up lights
18. Maintenance floodlights
19. Threshold lights
20. Strobe lights
21. Approach lights
22. Centerline lights
23. Runway lights
24. Rotation lights
25. Taxiway lights
26. Obstruction lights
27. Wind cone assembly
28. Landing signal light kit
29. Signal wands

The typical VLA configuration for 600' tactical sites is more elaborate than the small tactical site evaluated in the analysis.

LANDING SIGNAL LIGHT KIT (WHITE)

A battery operated kit (cloth tape with lights) which is attached to the overalls of the LSE to delineate the position of his arms and legs during night helicopter operations.

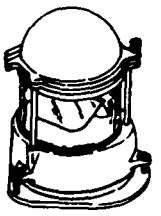


SIGNAL WANDS

Two hand-held flashlights, with interchangeable colored filters (red, green yellow, and blue), used by the LSE to give visual directions to the aircraft pilot during night operations

HOMING BEACON LIGHT (WHITE)

Mounted high on the AN/SPS-10F antenna platform to provide the helicopter pilot a visual guide (flashing white light beam) for homing when he approaches within the optical horizon



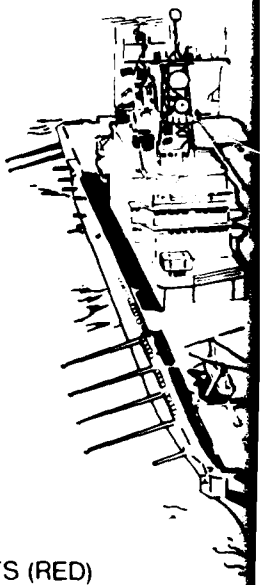
ROTARY BEACON

Provides visual color lights (either
amber, or green) to indicate to the pilot
deck crew the status of the flight deck

GREEN LIGHT - A clear deck
exists (landings and take-off are allowed

AMBER LIGHT - Engage or disengage
rotors

RED LIGHT - A foul deck situation
(landings and take-off are prohibited).



DECK EDGE LIGHTS (FLUSH)

The purpose of these globe-type edge lights is to outline the edge of the flight deck.

HELICOPTER LANDING SPOT LIGHT

Eleven white guide lights and one red main wheel marker light

Provides landing direction and position information for the pilot and LSE during the approach and landing of helicopters

AV-8 VERTICAL DROP-LINE LIGHTS (RED)

Assists the approaching AV-8 pilot in identifying the plane of the flight deck and in aligning the aircraft with the STOL line

PORTABLE HELICOPTER LANDING SPOT LIGHTS

Used to meet emergency situations and operating conditions that require spot arrangements other than the fixed landing spot lights

For example, when operating the H-1 helicopter

AV-8

The pur

TAKE-O
visual
crosses
indicate
nozzle

LANDI
mirror
the fore

TYPICAL LPH/LHA VISUAL L

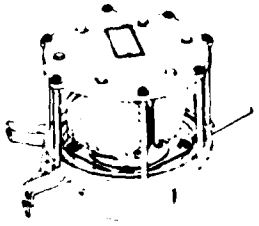
RY BEACON SIGNAL SYSTEM

al color lights (either red, to indicate to the pilot and e status of the flight deck

T - A clear deck situation s and take-off are allowed)

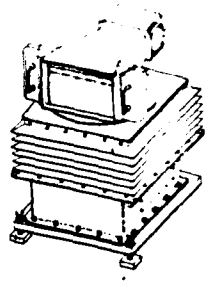
R - Engage or disengage

A foul deck situation exists take-off are prohibited)



STABILIZED GLIDE SLOPE INDICATOR

The stabilized GSI projects a tri-colored beam of light centered along a safe glide path to the ship (Green, Amber, Red). The pilot flies the amber beam (command path) to the ship.

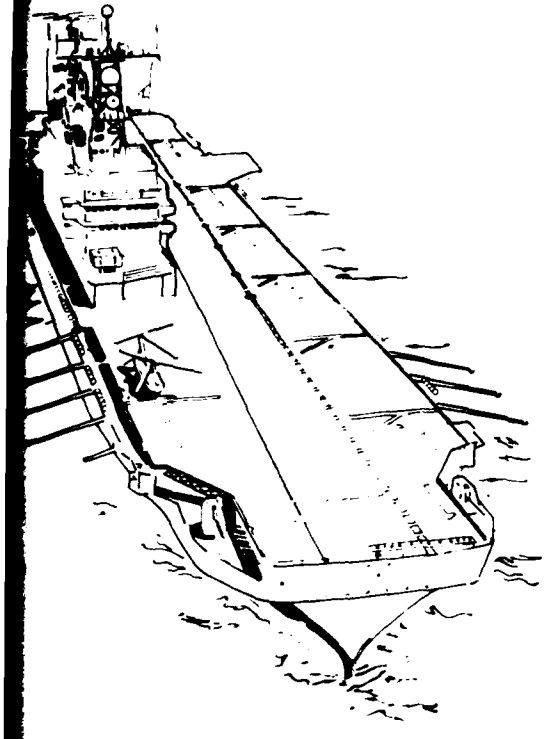


WAVE-OFF/CUT LIGHTS (RED)

Two lights located on either side of the GSI provide a visual cue signifying the following:

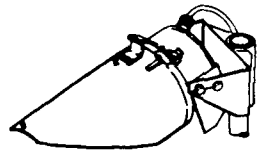
a. WAVE-OFF (Flashing) - unacceptable landing condition exists aboard ship

b. CUT - Predetermined signaling system initiated by the LSE to instruct the pilot during landings.



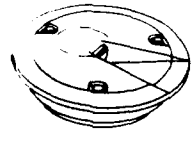
OVERHEAD FLOODLIGHTS (RED OR WHITE)

Provides adequate red or white overall illumination of the flight deck for support of helicopter and AV-8 night operations.



AV-8 STOL LINE LIGHTS (WHITE)

Provides the approaching AV-8 pilot line-up information to assist him in maintaining a course with the ship before transitioning to a hover and landing.



AV-8 NOZZLE ROTATION LINE LIGHT (AMBER)

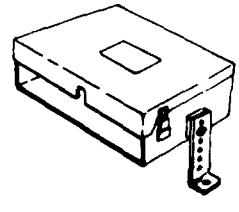
The purpose is two-fold:

TAKE-OFF - Provides the AV-8 pilot with a visual cue so that when the pilot's [illegible] crosses the nozzle rotation line lights it indicates to the pilot to rotate the aircraft's nozzle to insure sufficient lift for take-off.

LANDING - Assist the AV-8 pilot in [illegible] maintaining the ship's heading by identifying the forward end of the ship.

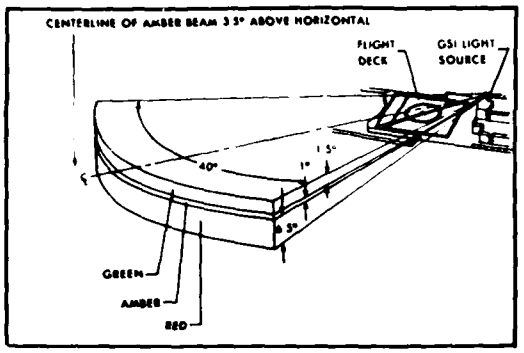
DECK SURFACE FLOODLIGHTS (RED OR WHITE)

Used to illuminate the flight deck with low level white or red light which provides depth perception to the pilot and facilitate night operations without impairing night vision.



UAL LANDING AIDS CONFIGURATION

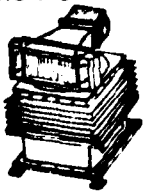
Figure 8-1



SPECIAL LIGHTING EQUIPMENT

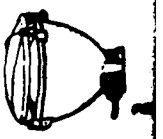
STABILIZED GLIDE SLOPE INDICATOR

The stabilized GSI projects a Tri-Colored beam of light centered along a safe glide path to the ship. The upper sector of the light beam is green, the center portion (command path) is amber, and the lower section is red.



SPECIAL LIGHTING EQUIPMENT

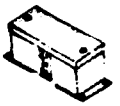
WAVE-OFF LIGHTS



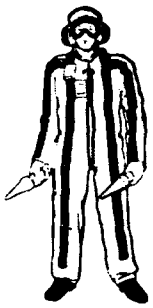
Two lights located on either side of the GSI provide a visual cue signifying an unacceptable landing condition aboard ship.

SPECIAL LIGHTING EQUIPMENT

EXTENDED LINE-UP LIGHTS (WHITE)



A forward extension of the deck mounted line-up lights, they provide the pilot with final position information for touchdown maneuver.



STANDARD LIGHTING EQUIPMENT

SIGNAL WANDS

Two flashlights with color filters

(RED)

STANDARD LIGHTING EQUIPMENT

EDGE LIGHTS

Outline the periphery of the obstruction free area and are located on the perimeter of the

STANDARD LIGHTING EQUIPMENT

LANDING SIGNAL LIGHT KIT

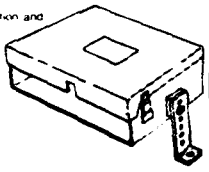
A battery operated kit which attaches to the coveralls of the Landing Signalman Enlisted (LSE) to delineate the arms and legs

SPECIAL LIGHTING EQUIPMENT

DECK SURFACE FLOODLIGHTS

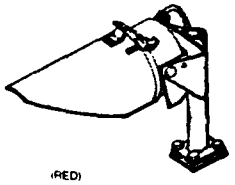
Provide additional depth perception and landing area definition

(RED or WHITE)



SPECIAL LIGHTING EQUIPMENT

MAINTENANCE FLOODLIGHT



For pre-flight and post-flight maintenance of a helicopter

(RED)

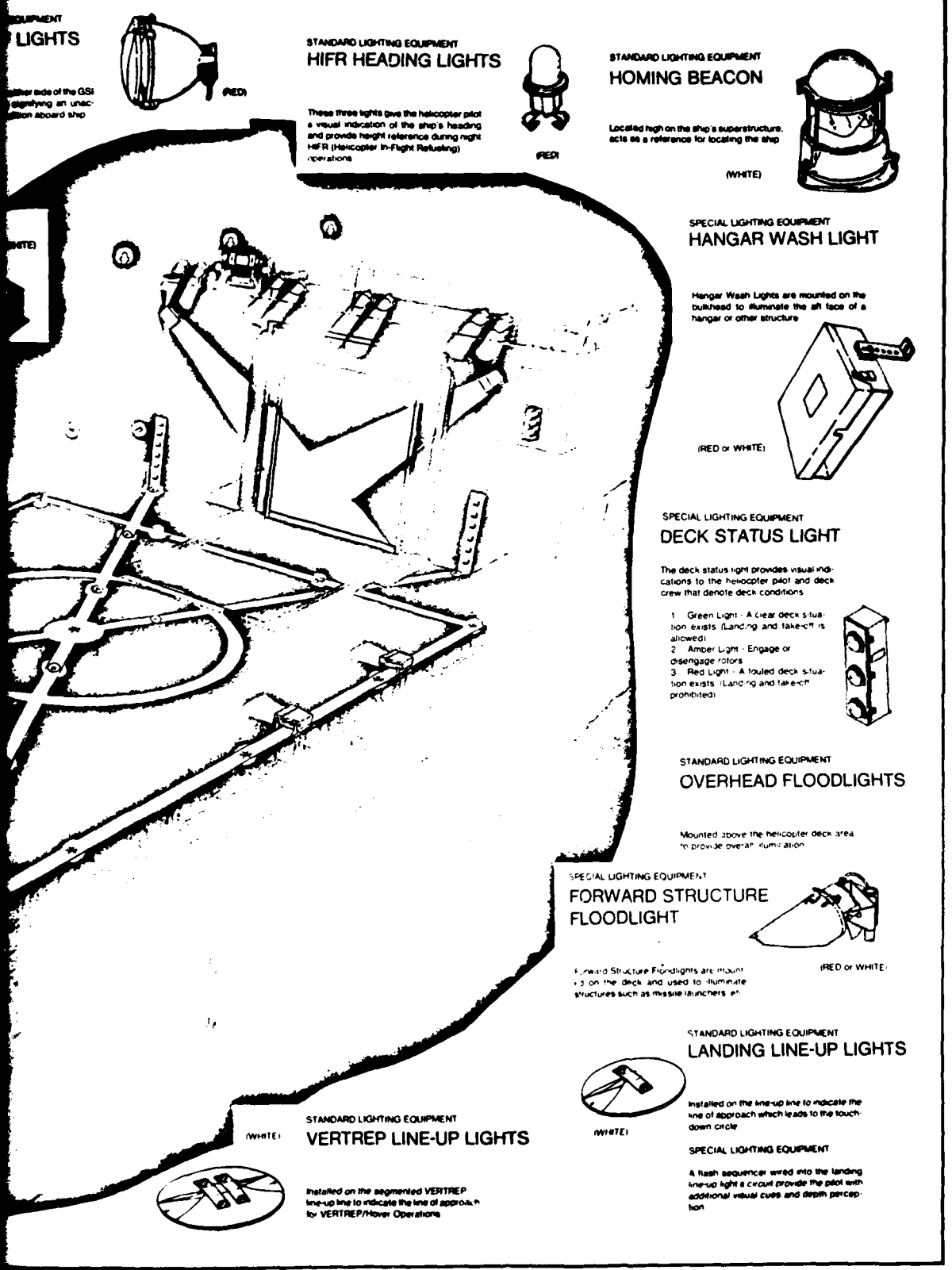
SPECIAL LIGHTING EQUIPMENT

VERTICAL DROP-LINE LIGHTS

An aft extension of the deck mounted line up lights provide pilot with continuous line up information when deck mounted line-up lights cannot be seen due to ship motion

(RED)

TYPICAL AIR CAPABLE SHIP VISUAL LANDING A



...UIPMENT
...LIGHTS

...ither side of the GSI ...signifying an unac- ...ation aboard ship

(RED)

STANDARD LIGHTING EQUIPMENT
HIFR HEADING LIGHTS

These three lights give the helicopter pilot a visual indication of the ship's heading and provide height reference during night HIFR (Helicopter In-Flight Refueling) operations

(RED)

STANDARD LIGHTING EQUIPMENT
HOMING BEACON

Located high on the ship's superstructure, acts as a reference for locating the ship

(WHITE)

...HITE)

SPECIAL LIGHTING EQUIPMENT
HANGAR WASH LIGHT

Hangar Wash Lights are mounted on the bulkhead to illuminate the aft face of a hangar or other structure

(RED or WHITE)

SPECIAL LIGHTING EQUIPMENT
DECK STATUS LIGHT

The deck status light provides visual indications to the helicopter pilot and deck crew that denote deck conditions

1. Green Light - A clear deck situation exists (Landing and take-off is allowed)
2. Amber Light - Engage or disengage rotors
3. Red Light - A fouled deck situation exists (Landing and take-off prohibited)

STANDARD LIGHTING EQUIPMENT
OVERHEAD FLOODLIGHTS

Mounted above the helicopter deck area to provide overall illumination

SPECIAL LIGHTING EQUIPMENT
FORWARD STRUCTURE FLOODLIGHT

(RED or WHITE)

...rward Structure Floodlights are mount- ...d on the deck and used to illuminate structures such as missile launchers, et...

STANDARD LIGHTING EQUIPMENT
LANDING LINE-UP LIGHTS

(WHITE)

Installed on the line-up line to indicate the line of approach which leads to the touchdown circle

SPECIAL LIGHTING EQUIPMENT

A flash sequencer wired into the landing line-up light circuit provide the pilot with additional visual cues and depth perception

(WHITE)

STANDARD LIGHTING EQUIPMENT
VERTREP LINE-UP LIGHTS

Installed on the segmented VERTREP line-up line to indicate the line of approach for VERTREP/Hover Operations

...L LANDING AIDS CONFIGURATION

Figure 8-2

...2

TAXIWAY LIGHTS (BLUE)

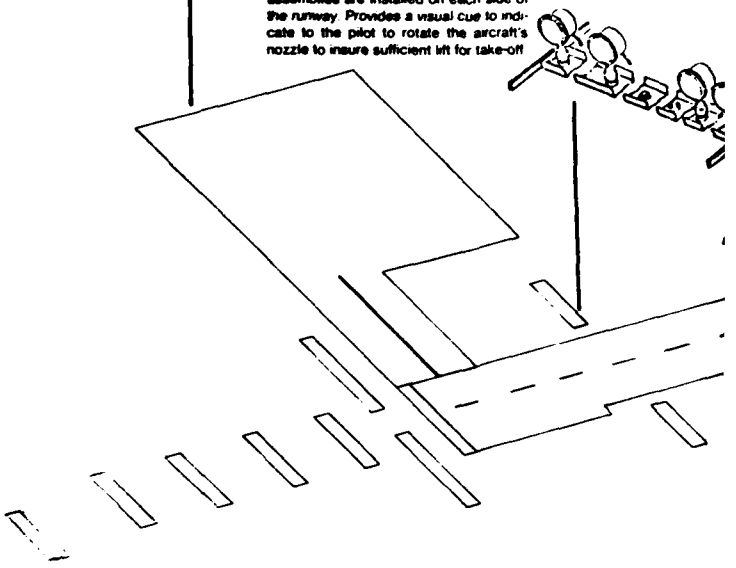
Marks the boundaries of the maintenance and parking areas and the taxiways.

OBSTRUCTION LIGHTS (R

Used to mark physical obstructions near the runways

ROTATION LIGHTS (YELLOW)

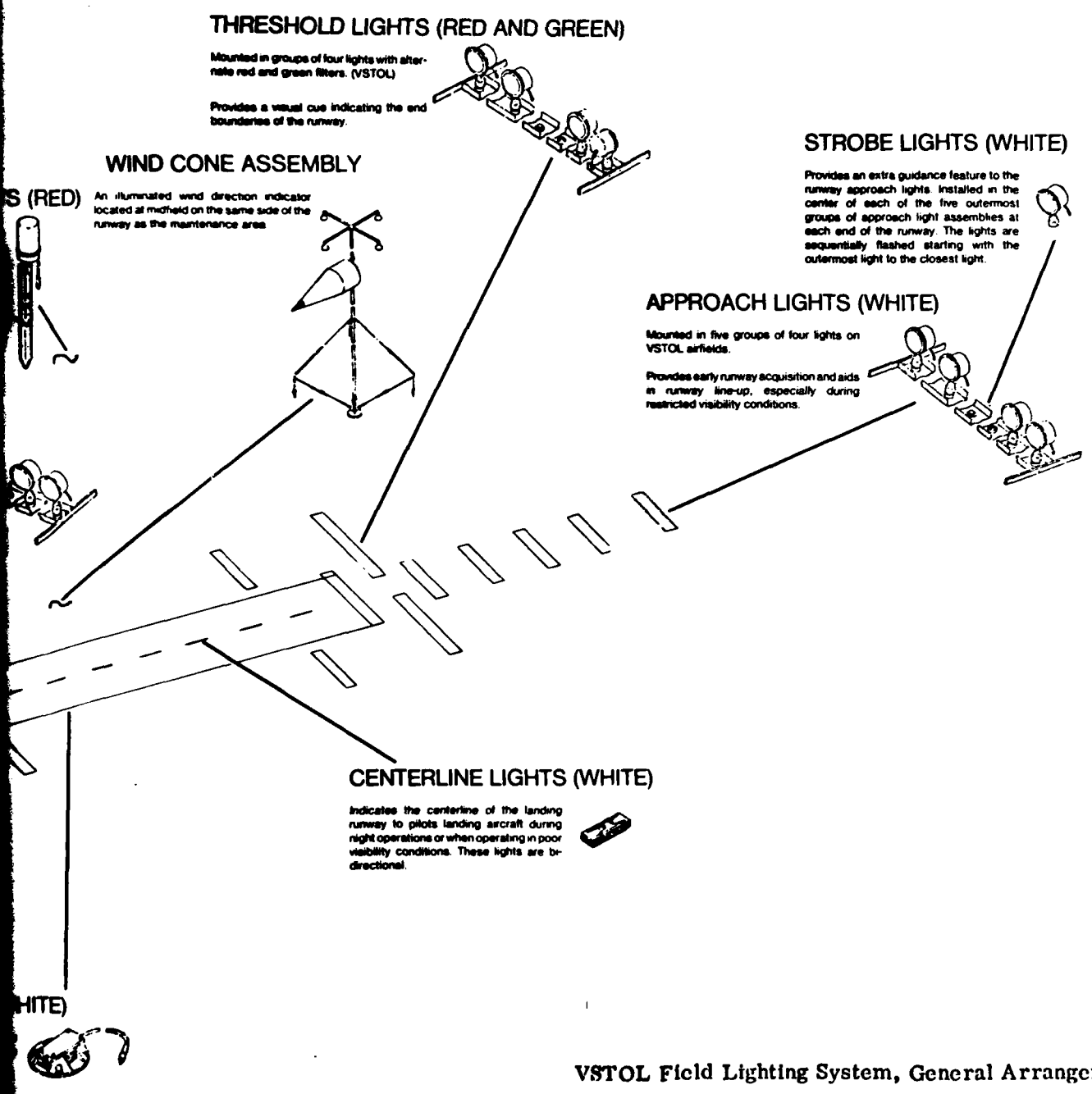
Same as approach light assemblies except four yellow filters are used. Four assemblies are installed on each side of the runway. Provides a visual cue to indicate to the pilot to rotate the aircraft's nozzle to insure sufficient lift for take-off.



RUNWAY LIGHTS (WHIT

Installed along both sides of the runway to indicate the side boundaries of the runway.

TYPICAL 600' TACTICAL SITE VISU



VSTOL Field Lighting System, General Arrangement

UAL LANDING AIDS CONFIGURATION

Figure 8-3

. 2

DISTRIBUTION LIST

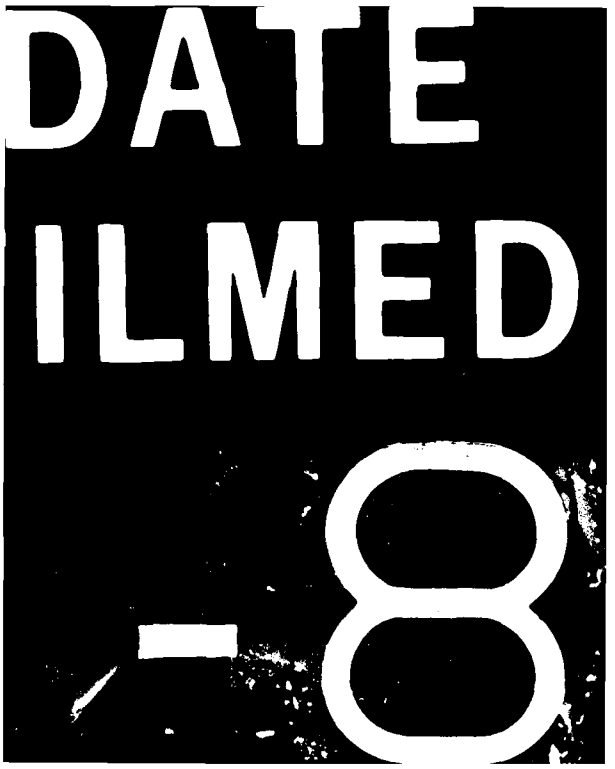
NAVAIRENGCEN
- 91B1 (6)
- 911 (3)
- 91118
- 912
- 902
- 903 (2)
- 943 (2)
- 9011

NAVAIRSYSCOM
- AIR-03PA4 (6)
- AIR-340E (3)
- AIR-551 (3)
- AIR-53355B (2)
- PMA-269 (2)
- PMA-266 (2)
- PMA-257 (2)

NADC (CODE 60142) (2)
NATC (CODE SA-71) (4)
NOSC (CODE 8216) (2)
NWC (CODE 4033)
DTNSRDC (CODE 1568)
NASA-AMES:MS:210-9

REVISION LIST

REVISION	PAGES AFFECTED	DATE OF REVISION


DATE
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-8